FOR YOUR SAFETY

If you smell gas:

1. **Open windows.**
2. **DO NOT try to light any appliance.**
3. **DO NOT use electrical switches.**
4. **DO NOT use any telephone in your building.**
5. **Leave the building.**
6. **Immediately call your local gas supplier after leaving the building. Follow the gas supplier's instructions.**
7. **If you cannot reach your gas supplier, call the Fire Department.**

⚠ WARNING

Fire Hazard

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

Some objects will catch fire or explode when placed close to heater.

Failure to follow these instructions can result in death, injury or property damage.

ROBERTS GORDON

Vantage® NP

Negative Pressure Unitary or Multiburner Infrared Heater

Installation, Operation & Service Manual

CTHN-40
CTHN-60
CTHN-80
CTHN-100
CTHN-125
CTHN-150
CTHN-175
CTHN-200

⚠ WARNING

Improper installation, adjustment, alteration, service or maintenance can result in death, injury or property damage. Read the Installation, Operation and Service Manual thoroughly before installing or servicing this equipment.

Installation must be done by a contractor qualified in the installation and service of gas-fired heating equipment or your gas supplier.

Installer

Please take the time to read and understand these instructions prior to any installation. Installer must give a copy of this manual to the owner.

Owner

Keep this manual in a safe place in order to provide your serviceman with necessary information.

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Quality in Any Language™

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P/N 152101NA Orig 06/06

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SECTION 1: HEATER SAFETY

Your Safety is Important to Us! This symbol is used throughout the manual to notify you of possible fire, electrical or burn hazards. Please pay special attention when reading and following the warnings in these sections.

Installation, service and annual inspection of heater must be done by a contractor qualified in the installation and service of gas-fired heating equipment.

Read this manual carefully before installation, operation or service of this equipment.

This heater is designed for heating nonresidential indoor spaces. Do not install in residential spaces. These instructions, the layout drawing, local codes and ordinances, and applicable standards that apply to gas piping, electrical wiring, venting, etc. must be thoroughly understood before proceeding with the installation.

Thin sheet metal parts, including the aluminum reflector and the various venting components, have sharp edges. To prevent injury, the use of work gloves is recommended. The use of gloves will also prevent the transfer of body oils from the hands to the surface of the reflector.

Before installation, check that the local distribution conditions, nature of gas and pressure, and adjustment of the appliance are compatible.

1.1 Manpower Requirements

To prevent personal injury and damage to the heater, two persons will be required for installation.

SECTION 2: INSTALLER RESPONSIBILITY

The installer is responsible for the following:

- To install the heater, as well as the gas and electrical supplies, in accordance with applicable specifications and codes. Roberts-Gordon recommends the installer contact a local Building Inspector or Fire Marshal for guidance.
- To use the information given in a layout drawing and in the manual together with the cited codes and regulations to perform the installation.
- To install the heater in accordance with the clearances to combustibles requirements.
- To furnish all needed materials not furnished as standard equipment.
- To plan location of supports.
- To provide access to burners on all sides for burner servicing and removal.
- To provide the owner with a copy of this Installation, Operation and Service Manual.
- To never use heater as a support for a ladder or other access equipment and never hang or suspend anything from heater.
- To ensure there is adequate air circulation around the heater and to supply air for combustion, ventilation and distribution in accordance with local codes.
- To safely and adequately install heater using materials with a minimal working load of 75 lbs (33 kg).

2.1 Wall Tag

A laminated wall tag is available for the heater as a permanent reminder of the safety instructions and the importance of the required clearances to combustibles. Please contact Roberts-Gordon or your ROBERTS GORDON® independent distributor to obtain the wall tag. Affix the tag by peeling off the backing of the adhesive strips on the rear surface and position the tag on a wall near the heater (e.g. thermostat or ROBERTS GORDON® Controller).

A copy of the wall tag (P/N 91037912) is illustrated on the back cover. For an immediate solution, you may affix this copy on the wall near the heater.

Know your model number and installed configuration. Model number and installed configuration are found on the burner and in the Installation, Operation and Service Manual. *See Page 3, Figure 1 through Page 6, Figure 10*. Write the proper clearance dimensions in permanent ink according to your model number and configuration in the open spaces on the tag.

2.2 Corrosive Chemicals

⚠ CAUTION

Do not use heater in an area containing corrosive chemicals.

Avoid the use of corrosive chemicals to ensure a longer life of the burner, tubing and other parts.

Failure to follow these instructions can result in property damage.

Roberts-Gordon cannot be responsible for ensuring that all appropriate safety measures are undertaken prior to installation; this is entirely the responsibility of the installer. It is essential that the contractor, the sub-contractor, or the owner identifies the presence of combustible materials, corrosive chemicals or halogenated hydrocarbons* anywhere in the premises.

** **Halogenated Hydrocarbons** are a family of chemical compounds characterized by the presence of halogen elements (fluorine, chlorine, bromine, etc.). These compounds are frequently used in refrigerants, cleaning agents, solvents, etc. If these compounds enter the air supply of the burner, the life span of the heater components will be greatly reduced. An outside air supply must be provided to the burners whenever the presence of these compounds is suspected. Warranty will be invalid if the heater is exposed to halogenated hydrocarbons.*

2.3 National Standards and Applicable Codes

All appliances must be installed in accordance with the latest revision of the applicable standards and national codes. This refers also to the electric, gas and venting installation. Note: Additional standards for installations in public garages, aircraft hangars, etc. may be applicable.

SECTION 3: CRITICAL CONSIDERATIONS

3.1 Required Clearances to Combustibles

Clearances are the required distances that combustible objects must be away from the heater to prevent fire hazards. Combustible materials that may catch fire include common items such as wood, paper, rubber, fabric, etc. **Maintain clearances to combustibles at all times for safety.**

Clearances for all heater models are located on the burner of the heater and *on Page 3, Figure 1 through Page 6, Figure 10* in this manual. Check the clearances on each burner for the model heater being installed to make sure the product is suitable for your application and the clearances are maintained. Read and follow the safety guidelines below:

- Keep gasoline or other combustible materials including flammable objects, liquids, dust or vapors away from this heater or any other appliance.
- Maintain clearances from heat sensitive material, equipment and workstations.
- Maintain clearances from vehicles parked below the heater.
- Maintain clearances from swinging and overhead doors, overhead cranes, vehicle lifts, partitions, storage racks, hoists, building construction, etc.
- In locations used for the storage of combustible materials, signs must be posted to specify the maximum permissible stacking height to maintain required clearances from the heater to the combustibles. Signs must be posted adjacent to the heater thermostat. In the absence of a thermostat, signs must be posted in a conspicuous location.
- Consult local Fire Marshal, Fire Insurance Carrier or other authorities for approval of proposed installation when there is a possibility of exposure to combustible airborne materials or vapors.
- Hang heater in accordance to the minimum suspension requirements *on Page 10, Figure 12*.
- If the radiant tubes must pass through the building structure, be sure that adequate sleeving and fire stop is installed to prevent scorching and/or fire hazard.

⚠ WARNING

Fire Hazard

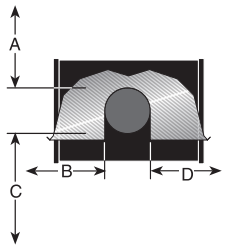
Some objects will catch fire or explode when placed close to heater.

Keep all flammable objects, liquids and vapors the required clearances to combustibles away from heater.

Failure to follow these instructions can result in death, injury or property damage.

NOTE: 1. All dimensions are from the surfaces of all tubes, couplings and elbows.
2. Clearances B, C and D can be reduced by 50% after 25' (7.5 m) of tubing downstream from where the burner and burner tube connect.

FIGURE 1: STANDARD REFLECTOR

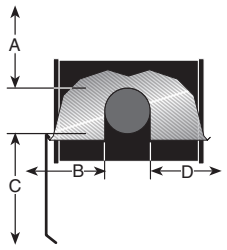


Model	(inches) A	B	C	D	(centimeters) A	B	C	D
CTHN-40	5	20	41	20	13	51	104	51
CTHN-60	5	27	51	27	13	69	130	69
CTHN-80	5	30	58	30	13	76	147	76
CTHN-100	5	32	60	32	13	81	152	81
CTHN-125	5	35	65	35	13	89	165	89
CTHN-150	5	39	71	39	13	99	180	99
CTHN-175	8	44	74	44	20	112	188	112
CTHN-200	8	47	76	47	20	119	193	119

NOTE: 1. All dimensions are from the surfaces of all tubes, couplings and elbows.
2. Clearances B, C and D can be reduced by 50% after 25' (7.5 m) of tubing downstream from where the burner and burner tube connect.

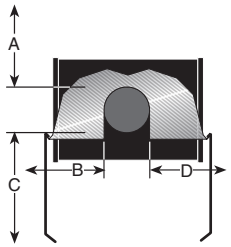
.

FIGURE 2: ONE SIDE REFLECTOR



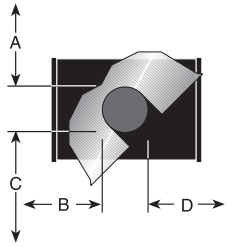
Model	(inches) A	B	C	D	(centimeters) A	B	C	D
CTHN-40	5	6	46	20	13	15	117	51
CTHN-60	5	6	55	27	13	15	140	69
CTHN-80	5	6	64	30	13	15	163	76
CTHN-100	5	6	66	32	13	15	168	81
CTHN-125	5	6	69	35	13	15	175	89
CTHN-150	5	6	75	39	13	15	191	99
CTHN-175	8	6	77	44	20	15	196	112
CTHN-200	8	6	79	47	20	15	201	119

FIGURE 3: TWO SIDE REFLECTORS



Model	(inches) A	B	C	D	(centimeters) A	B	C	D
CTHN-40	5	16	47	16	13	41	119	41
CTHN-60	5	18	56	18	13	46	142	46
CTHN-80	5	21	65	21	13	53	165	53
CTHN-100	5	23	68	23	13	58	173	58
CTHN-125	5	26	73	26	13	66	185	66
CTHN-150	5	30	76	30	13	76	193	76
CTHN-175	8	32	88	32	20	81	224	81
CTHN-200	8	33	90	33	20	84	229	84

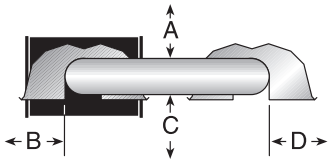
FIGURE 4: 45° TILT REFLECTOR



Model	(inches) A	B	C	D	(centimeters) A	B	C	D
CTHN-40	8	4	35	43	20	10	89	109
CTHN-60	8	4	45	45	20	10	114	114
CTHN-80	9	4	54	55	23	10	137	140
CTHN-100	10	4	57	56	25	10	145	142
CTHN-125	10	4	63	58	25	10	160	147
CTHN-150	10	4	66	61	25	10	168	155
CTHN-175	10	4	69	68	25	10	175	173
CTHN-200	10	4	73	71	25	10	185	180

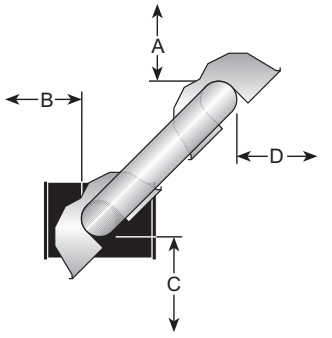
NOTE: 1. All dimensions are from the surfaces of all tubes, couplings and elbows.
2. Clearances B, C and D can be reduced by 50% after 25' (7.5 m) of tubing downstream from where the burner and burner tube connect.

FIGURE 5: U-TUBE, STANDARD REFLECTOR



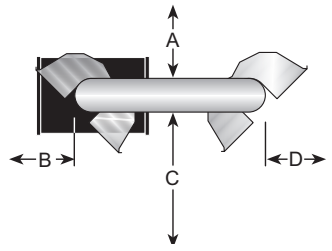
Model	(inches) A	B	C	D	(centimeters) A	B	C	D
CTHN-40	- UNAPPROVED -				- UNAPPROVED -			
CTHN-60	5	27	56	19	13	69	142	48
CTHN-80	5	30	61	20	13	76	155	51
CTHN-100	5	32	63	20	13	81	160	51
CTHN-125	5	35	66	20	13	89	168	51
CTHN-150	5	39	73	21	13	99	185	53
CTHN-175	8	44	75	26	20	112	191	66
CTHN-200	8	47	76	30	20	119	193	76

FIGURE 6: U-TUBE, 45°



Model	(inches) A	B	C	D	(centimeters) A	B	C	D
CTHN-40	- UNAPPROVED -				- UNAPPROVED -			
CTHN-60	8	4	47	40	20	10	119	102
CTHN-80	8	4	54	46	20	10	137	117
CTHN-100	8	4	57	48	20	10	145	122
CTHN-125	8	4	63	53	20	10	160	135
CTHN-150	8	4	66	56	20	10	168	142
CTHN-175	8	4	69	59	20	10	175	150
CTHN-200	8	4	73	63	20	10	185	160

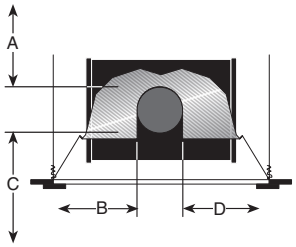
FIGURE 7: U-TUBE, OPPOSITE 45° REFLECTOR



Model	(inches) A	B	C	D	(centimeters) A	B	C	D
CTHN-40	- UNAPPROVED -				- UNAPPROVED -			
CTHN-60	8	45	45	10	20	114	114	25
CTHN-80	9	55	54	10	23	140	137	25
CTHN-100	10	56	57	10	25	142	145	25
CTHN-125	10	58	63	10	25	147	160	25
CTHN-150	10	61	66	20	25	155	168	51
CTHN-175	10	68	69	20	25	173	175	51
CTHN-200	10	71	73	20	25	180	185	51

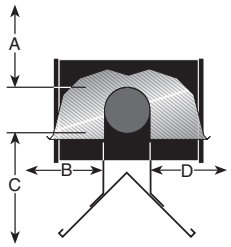
NOTE: 1. All dimensions are from the surfaces of all tubes, couplings and elbows.
2. Clearances B, C and D can be reduced by 50% after 25' (7.5 m) of tubing downstream from where the burner and burner tube connect.

FIGURE 8: 2-FOOT DECO GRILLE, 1-FOOT DECO GRILLE AND PROTECTIVE GRILLE



Model	(inches) A	B	C	D	(centimeters) A	B	C	D
CTHN-40	5	20	41	20	13	51	104	51
CTHN-60	5	27	51	27	13	69	130	69
CTHN-80	5	30	58	30	13	76	147	76
CTHN-100	5	32	60	32	13	81	152	81
CTHN-125	5	35	65	35	13	89	165	89
CTHN-150	5	39	71	39	13	99	180	99
CTHN-175	8	44	74	44	20	112	188	112
CTHN-200	8	47	76	47	20	119	193	119

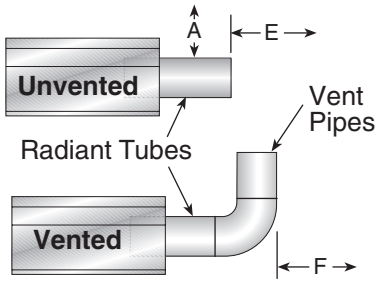
FIGURE 9: LOWER CLEARANCE SHIELD*



Model	(inches) A	B	C	D	(centimeters) A	B	C	D
CTHN-40	5	25	22	25	13	64	56	64
CTHN-60	5	30	27	30	13	76	69	76
CTHN-80	5	37	37	37	13	94	94	94
CTHN-100	5	39	39	39	13	99	99	99
CTHN-125	5	41	41	41	13	104	104	104
CTHN-150	5	43	50	43	13	109	127	109
CTHN-175	**- UNAPPROVED -**				**- UNAPPROVED -**			
CTHN-200	**- UNAPPROVED -**				**- UNAPPROVED -**			

*When installed in the first 10' (3 m).

FIGURE 10: VENTING



Model	(inches) A	E	F	(centimeters) A	E	F
CTHN-40	14	18	18	36	46	46
CTHN-60	14	18	18	36	46	46
CTHN-80	20	24	18	51	61	46
CTHN-100	20	24	18	51	61	46
CTHN-125	20	24	18	51	61	46
CTHN-150	20	30	18	51	76	46
CTHN-175	20	30	18	51	76	46
CTHN-200	20	30	18	51	76	46

SECTION 4: NATIONAL STANDARDS AND APPLICABLE CODES

4.1 Gas Codes

The type of gas appearing on the nameplate must be the type of gas used. Installation must comply with national and local codes and requirements of the local gas company.

United States: Refer to National Fuel Gas Code, ANSI Z223.1 - latest revision (same as NFPA 54).

Canada: Refer to CAN/CGA B149.1 and B149.2: Installation Codes for Gas Burning Appliances.

4.2 Aircraft Hangars

Installation in aircraft hangars must be in accordance with the following codes:

United States: Refer to Standard for Aircraft Hangars, ANSI/NFPA-409 - latest revision.

Canada: Refer to Standard CAN/CGA B149.1 and B149.2: Installation Codes for Gas Burning Appliances.

• In aircraft storage and servicing areas, heaters shall be installed at least 10' (3 m) above the upper surface of wings or of engine enclosures of the highest aircraft which may be housed in the hangar. The measurement shall be made from the wing or engine enclosure (whichever is higher from the floor) to the bottom of the heater.

• In shops, offices and other sections of aircraft hangars communicating with aircraft storage or servicing areas, heaters shall be installed not less than 8' (2.4 m) above the floor.

• Suspended or elevated heaters shall be so located in all spaces of aircraft hangars that they shall not be subject to injury by aircraft, cranes, movable scaffolding or other objects. Provisions shall be made to assure accessibility to suspended heaters for recurrent maintenance purposes.

4.3 Public Garages

Installation in garages must be in accordance with the following codes:

United States: Standard for Parking Structures NFPA-88A - latest revision or the Code for Motor Fuel Dispensing Facilities and Repair Garages, NFPA-30A - latest revision. Canada: Refer to CAN/CGA B149.1 and B149.2: Installation Codes for Gas Burning Appliances.

• Heaters must not be installed less than 8' (2.4 m) above the floor. Minimum clearances to combustibles must be maintained from vehicles parked below the heater.

• When installed over hoists, minimum clearances to combustibles must be maintained from the upper most point of objects on the hoist.

4.4 Electrical

The heater must be electrically grounded in accordance with the following codes:

United States: Refer to National Electrical Code®, ANSI/NFPA-70 - latest revision. Wiring must conform to the most current National Electrical Code®, local ordinances, and any special diagrams furnished.

Canada: Refer to Canadian Electrical Code, CSA C22.1 Part 1 - latest revision.

4.5 Venting

The venting must be installed in accordance with the requirements within this manual and the following codes:

United States: Refer to NFPA-54/ANSI Z223.1 - latest revision, National Fuel Gas Code.

Canada: Refer to CAN/CGA B149.1 and B149.2: Installation Codes for Gas Burning Appliances.

4.6 High Altitude

These heaters are approved for installations up to 2000' (610 m)(US), 4500' (1370 m)(Canada) without modification. Consult factory if US installation is above 2000' (610 m) or Canadian installation is above 4500' (1370 m).

SECTION 5: HEATER DESCRIPTIONS

5.1 Unitary vs. Multiburner

CTHN-Series burners may be used for unitary heaters or for multiburner systems.

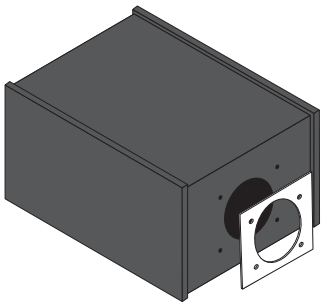
Unitary heaters consist of a single burner, a single run of radiant tubing and a single fan assembly. *See Page 14, Figure 13* or *See Page 17, Figure 16* for details.

Multiburner systems consist of more than one burner and more than one run of radiant tubing. The runs of radiant tubing are connected together by manifold tubing. The manifold tubing connects to a single pump that exhausts the flue gases outdoors. *See Page 32, Figure 19 through Page 35, Figure 23* for common multiburner system layouts.

Since this manual addresses installation of both unitary heaters and multiburner systems, pay close attention to section and figure titles to verify relevance to unitary heaters or multiburner systems.

SECTION 6: MAJOR COMPONENTS

FIGURE 11: Major Component Descriptions



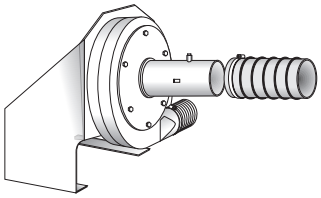
Burner with Tube Gasket
Must be installed with the flame observation window facing down.

Reflector (Aluminum or Stainless Steel)
Alternate overlap as shown *on Page 15, Figure 14* or *on Page 18, Figure 17*. Minimum overlap is 6" (16 cm).

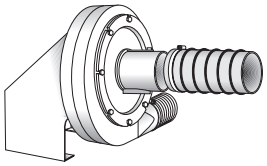
Burner Tube
Supplied in 10' (3 m) lengths. Burner tube is always the first tube after the burner.

Tube
Hot rolled or heat treated aluminized tube supplied in 10' (3 m) lengths.

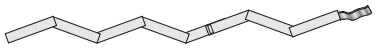
Coupling Assembly with Lock



EP-100 Pump Package -
For more information, refer to the EP-100 Installation, Operation and Service Manual (P/N 127201NA).

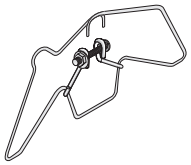


EP-201 Pump Package -
For more information, refer to the EP-200 Series Installation, Operation and Service Manual (P/N 127200NA).

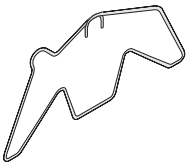


Turbulator
Turbulator must be installed in the last standard section of tube.Turbulator is only required on the CTHN-40, 60 and 80. For installation, *See Page 21, Step 8.8*.

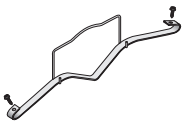
Flex Gas Line with Shut Off Cock



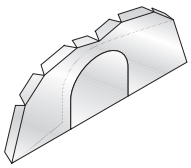
Tube and Reflector Hanger with Clamp Package
Position this hanger no more than 4" (10 cm) away from the burner assembly.



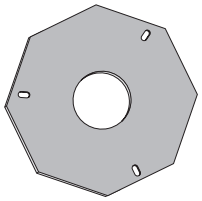
Tube and Reflector Hanger
Suspend system from these hangers.



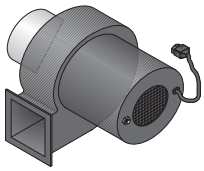
Reflector Support Strap & Wire Form



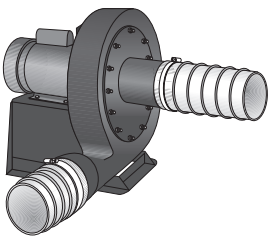
Reflector End Cap
Punch out center section to accommodate tube.



Restrictor Plate
Used at fan assembly inlet for unitary heaters only. See fan assembly below.



Fan Assembly



EP-300 Series
Pump Package -
For more information, refer to the EP-300 Series Installation, Operation and Service Manual (P/N 127202NA).

SECTION 7: GENERAL SUSPENSION DETAILS

⚠ WARNING

Suspension Hazard

Burner is secured to burner tube by bolts and lockwashers.

Hang heater with materials with a minimum working load of 75 lbs (33 kg).

Failure of the supports can result in death, injury or property damage.

To ensure your safety and comply with the terms of the warranty, all units must be installed in accordance with these instructions.

The gas or the electrical supply lines must not be used to support the heater.

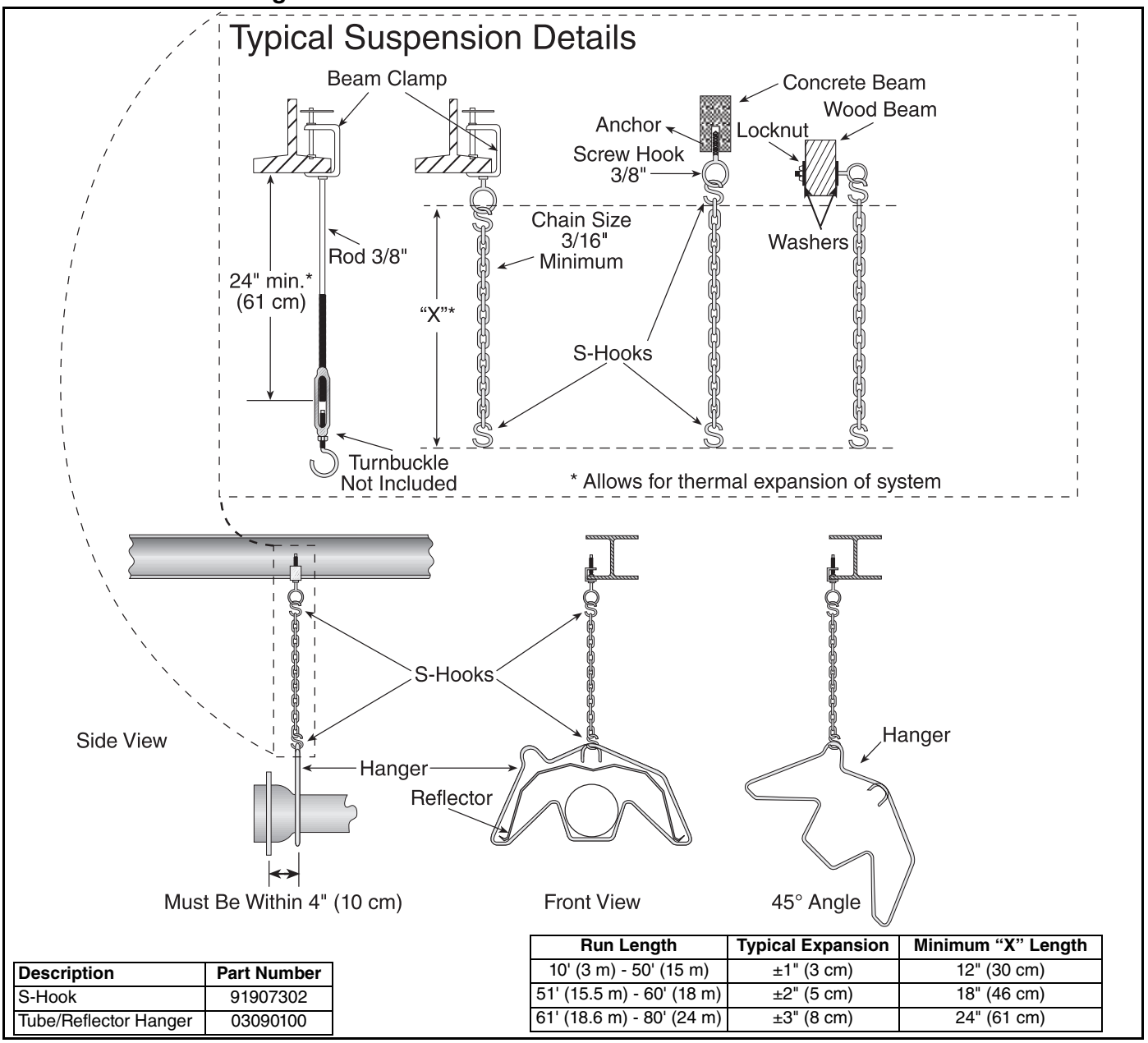
Do not locate the gas or electric supply lines directly over the path of the flue products from the heater.

The heater must be installed in a location that is readily accessible for servicing.

The heaters must be installed in accordance with clearances to combustibles as indicated on the rating plate and in this instruction manual.

The minimum and maximum gas inlet pressures must be maintained as indicated on the rating plate.Typical installation configurations are shown in *Figure 12*.

FIGURE 12: Critical Hanger Placement



Description	Part Number
S-Hook	91907302
Tube/Reflector Hanger	03090100

Run Length	Typical Expansion	Minimum "X" Length
10' (3 m) - 50' (15 m)	±1" (3 cm)	12" (30 cm)
51' (15.5 m) - 60' (18 m)	±2" (5 cm)	18" (46 cm)
61' (18.6 m) - 80' (24 m)	±3" (8 cm)	24" (61 cm)

SECTION 8: UNITARY LINEAR & U-TUBE HEATER INSTALLATION

8.1 Standard Parts

Table 1: Contents of CTHN Burner Carton

Part No.	Description	CTHN-40	CTHN-60	CTHN-80	CTHN-100	CTHN-125	CTHN-150	CTHN-175	CTHN-200
052XXXXX	Burner (Rate and Fuel Varies)	1	1	1	1	1	1	1	1
07730400	Restrictor Plate 1.25" (3.2 cm) dia.	1	-	-	-	-	-	-	-
07730100	Restrictor Plate 1.50" (3.8 cm) dia.	-	1	-	-	-	-	-	-
07730500	Restrictor Plate 2.25" (5.7 cm) dia.	-	-	-	1	1	-	-	-
07730600	Restrictor Plate 2.50" (6.4 cm) dia.	-	-	-	-	-	-	1	-
07730700	Restrictor Plate 2.75" (7 cm) dia.	-	-	-	-	-	1	-	-
03051503	Turbulator Adapter	1	1	1	-	-	-	-	-
03051504	Turbulator Section	2	4	4	-	-	-	-	-
03051505	Turbulator Section, Stainless Steel	1	-	-	-	-	-	-	-
*91412200	Flexible Stainless Steel Gas Hose , 1/2" NPT (US Models Only)	1	1	1	1	1	-	-	-
*91412203	Flexible Stainless Steel Gas Hose , 3/4" NPT (US Models Only)	-	-	-	-	-	1	1	1
02568200	Gasket (Burner to Burner Tube)	1	1	1	1	1	1	1	1
94273914	Hex Head Cap Screw 5/16" -18 x 7/8"	4	4	4	4	4	4	4	4
96411600	Split Lock Washer	4	4	4	4	4	4	4	4
91201708	Pipe Nipple 1/2" NPT x 4"	1	1	1	1	1	1	1	1
152101NA	Installation, Operation and Service Manual	1	1	1	1	1	1	1	1

*Canadian Models: Rubber (Type 1) Gas Hoses available as an accessory. *See Page 69, Section 16*.

Table 2: Contents of Core and Extension Packages

		Core Packages							Extension Packages							
		Hot Rolled			Aluminized				Hot Rolled				Aluminized			
Part No.	Description	20' (6m)	30' (9m)	40' (12m)	10' (3m)	20' (6m)	30' (9m)	40' (12m)	10' (3m)	20' (6m)	30' (9m)	40' (12m)	10' (3m)	20' (6m)	30' (9m)	40' (12m)
91409300	Tube, Hot Rolled Steel, 10' (3 m)	1	2	3	-	-	-	-	1	2	3	4	-	-	-	-
91409408	Tube, HT Aluminized, 10' (3 m)	-	-	-	-	1	2	3	-	-	-	-	1	2	3	4
03051101	Burner Tube, ALUMI-THERM® Steel, 10' (3 m)	-	1	1	-	-	1	1	-	-	-	-	-	-	-	-
03051601	Burner Tube, HT ALUMI-THERM® Steel, 10' (3 m)	1	-	-	1	1	-	-	-	-	-	-	-	-	-	-
01312700	Coupling Assembly	1	2	3	-	1	2	3	1	2	3	4	1	2	3	4
02750303	Standard Reflector, 8' (2.4 m)	3	4	6	2	3	4	6	2	3	4	6	2	3	4	6
02750800	End Cap	2	2	2	2	2	2	2	-	-	-	-	-	-	-	-
03090100	Tube and Reflector Hanger	3	4	5	2	3	4	5	1	2	3	4	1	2	3	4
91907302	S-hook	3	4	5	2	3	4	5	1	2	3	4	1	2	3	4
03050010	Reflector Support Package (Strap, Wire Form, Screws)	2	3	5	1	2	3	5	2	3	4	6	2	3	4	6
91107720	U-clip Package	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
90502700	Vent Adapter (Not used on CTHN)	1	1	1	1	1	1	1	-	-	-	-	-	-	-	-
01318901	Tube Clamp Package	1	1	1	1	1	1	1	-	-	-	-	-	-	-	-

Table 3: Component Package Guide

Model	Tubing Length	Core Packages	
	Minimum	Standard	Aluminized
CTHN-40	10' (3 m)	CP10ALUM	CP10ALUM
CTHN-60	20' (6 m)	CP20HRS	CP20ALUM
CTHN-80	20' (6 m)	CP20HRS	CP20ALUM
CTHN-100	30' (9 m)	CP30HRS	CP30ALUM
CTHN-125	40' (12 m)	CP40HRS	CP40ALUM
CTHN-150	40' (12 m)	CP40HRS	CP40ALUM
CTHN-175	50' (15 m)	CP30HRS + EXP20HRS	CP30ALUM + EXP20ALUM
CTHN-200	50' (15 m)	CP30HRS + EXP20HRS	CP30ALUM + EXP20ALUM

Additional tubing length may be added to heater.
Any additional tubing lengths are considered as vent length for length determination.
Maximum venting length for unitary heater is 45' (13.7 m).
For manifold tubing on multiburner systems, heat-treated aluminized or porcelain coated tubing is required.

Table 4: Common CTHN-Series Components

Part No.	Description
Tubing and Related Accessories	
01312700	Coupling, 4" (10 cm) Plain
01312706	Coupling, 6" (15 cm) Plain
0131270I	Coupling, 4" (10 cm) Lined
01331900	Coupling, 4" (10 cm) Damper
E0009356	Coupling, 6" (15 cm) Damper
0133022D	Tee, 4" (10 cm) Coated
01330203	Tee, 4" (10 cm) Aluminized
01330204	Tee, 6" (15 cm) Aluminized
0133092D	Cross, 4" (10 cm) Coated
01330903	Cross, 4" (10 cm) Aluminized
01330904	Cross, 6" (15 cm) Aluminized
01335801	Elbow, 4" (10 cm) Aluminized 90°
T0100320	Elbow, 6" (15 cm) Aluminized 90°
0133580D	Elbow, 4" (10 cm) Coated 90°
01336101	Elbow, 4" (10 cm) Aluminized 45°
0133610D	Elbow, 4" (10 cm) Coated 45°
91409300	Tube, 4" (10 cm) dia Hot Rolled Steel 10' (3 m)
91409403	Tube, 4" (10 cm) dia Non-Heat Treated Aluminized 10' (3 m)
91409408	Tube, 4" (10 cm) dia Heat Treated Aluminized 10' (3 m)
91409420	Tube, 6" (15 cm) dia Non-Heat Treated Aluminized 10' (3 m)
9141030D	Tube, 4" (10 cm) dia Coated 10' (3 m)
E0009105	Tube, 6" (15 cm) dia 10' (3 m) Heat Treated Aluminized
91418200	Tube Adapter, 6" (15 cm) dia x 4"(10 cm) dia Aluminized
91240010	Tube Hanger, 6" (15 cm)
91308001	Pipe Compound, High Temperature 1lb can

Venting Accessories	
01324401	Air Supply Takeoff, 4" (10 cm) Outside
90707501	Air Supply Blower/Power Venter
91409601	Air Flex Duct, 4" (10 cm) Outside (Box of 8 - 8' (2.4 m) sections)

Reflectors and Related Accessories	
01329910	Reflector Side Extension Support
03050010	Reflector Support Package (Tubing)
02712700	Reflector Side Extension, 2 Clips, 2 Screws
02750303	Reflector, Aluminum
027503SS	Reflector, Stainless Steel
02750800	Reflector End Cap, Aluminum
027508SS	Reflector End Cap, Stainless Steel
027508SH	Reflector End Cap, Stainless Steel with Hole
02750900	Reflector Joint
027509SS	Reflector Joint, Stainless Steel
027127SS	Reflector Side Extension, Stainless Steel
03090100	Tube and Reflector Hanger
91907302	S-hook
91903201	Turnbuckle
91903300	Spring Hook
91903202	Turnbuckle with Eyebolt

Control Packages and Thermostats	
02770002	System Control
05023000	Load Relay Package
90417600	Transformer Relay - SPST (12 A)
90436300	Transformer Relay - DPST (12 A)
90423000	Thermostat, 24 V Low Voltage (Marked 1-5)
90424300	Thermostat Guard

Deco Grille (1' x 8' [.3 m x 2.4 m])	
01363003	Bracket
01365901	End Piece
01326801	Reinforcement
01365903	Joint Piece
91406700	1' x 8' (.3 m x 2.4 m) Protective Grille

Deco Grille (2' x 4' [.6 m x 1.2 m])	
01365900	Shield Frame
01370408	Reflector Side Extension 8" x 48" (20 cm x 122 cm)
01370412	Reflector Side Extension 12" x 48" (30 cm x 122 cm)
01370416	Reflector Side Extension 16" x 48" (40 cm 122 cm)
91407000	Grille, Aluminum 2' x 4' (.6 m x 1.2 m)

Protective Grille	
08050001	Grille, 40" (102 cm) Protective
08050002	Protective Grille End Cap

Fan and Pump Packages	
05220000	Fan Package 40-150
05221000	Fan Package 175-200
02719105	**EP-100 Pump Package**
02719100	EP-100 Pump
02724700	Accessory Package
02716305	**EP-201 Pump Package**
01312001	EP-201 Pump
01317805	Accessory Package
02712034	**EP-203 Pump Package**
01312002	EP-203 Pump
01317805	Accessory Package
02723014	**EP-301 Pump Package 4"** (10 cm)
02730101	EP-301 Pump Assembly
02730104	Accessory Package
02723016	**EP-301 Pump Package 6"** (15 cm)
02730101	EP-301 Pump Assembly
02730106	Accessory Package
02723034	**EP-303 Pump Package 4"** (10 cm)
02730103	EP-303 Pump Assembly
02730104	Accessory Package
02723036	**EP-303 Pump Package 6"** (15 cm)
02730103	EP-303 Pump Assembly
02730106	Accessory Package

Pump Accessories	
90430600K	Pressure Switch

Starters and Contactors	
10050001	Starter, 120 Vac for EP-203, 3 Ø
10050003	Starter, 120 Vac for EP-201, 1 Ø
10050008	Starter, 120 Vac for EP-301, 1 Ø
10050009	Contactor Package- 120 Vac Coil for EP-301, 230 V, 2 HP
10050010	Starter, 120 Vac for EP-303, 3 Ø

8.2 Unitary Heater Requirements

CTHN unitary heaters are typically shipped as a burner package, fan assembly and a tube and accessory package. The tube and accessory packages contain enough tube, reflector and hanging parts for one unitary CTHN heater. Elbows, u-tubes, controls, and any other parts must be purchased separately.

See Page 14, Figure 13 for a general overview of a CTHN unitary heater. CTHN unitary heaters are controlled by thermostat.

Table 5 summarizes the design requirements for a CTHN unitary heater.

Table 5: Unitary Heater Design Requirements

Burner Model:	CTHN-40	CTHN-60	CTHN-80	CTHN-100	CTHN-125	CTHN-150	CTHN-175	CTHN-200
Maximum Number of Burners Allowed per Fan Assembly (P/N 05220000)	1	1	1	1	1	1	-	-
Maximum Number of Burners Allowed per Fan Assembly (P/N 05221000)	-	-	-	-	-	-	1	1
Minimum Radiant Tube Length	10' (3 m)	20' (6 m)	20' (6 m)	30' (9 m)	40' (12 m)	40' (12 m)	50' (15 m)	50' (15 m)
Minimum Distance from Burner to Elbow or U-Tube	10' (3 m)	10' (3 m)	10' (3 m)	15' (4.5 m)	15' (4.5 m)	20' (6 m)	20' (6 m)	20' (6 m)

8.3 Unitary Linear Heater Layouts

FIGURE 13: Linear Heater Assembly Overview

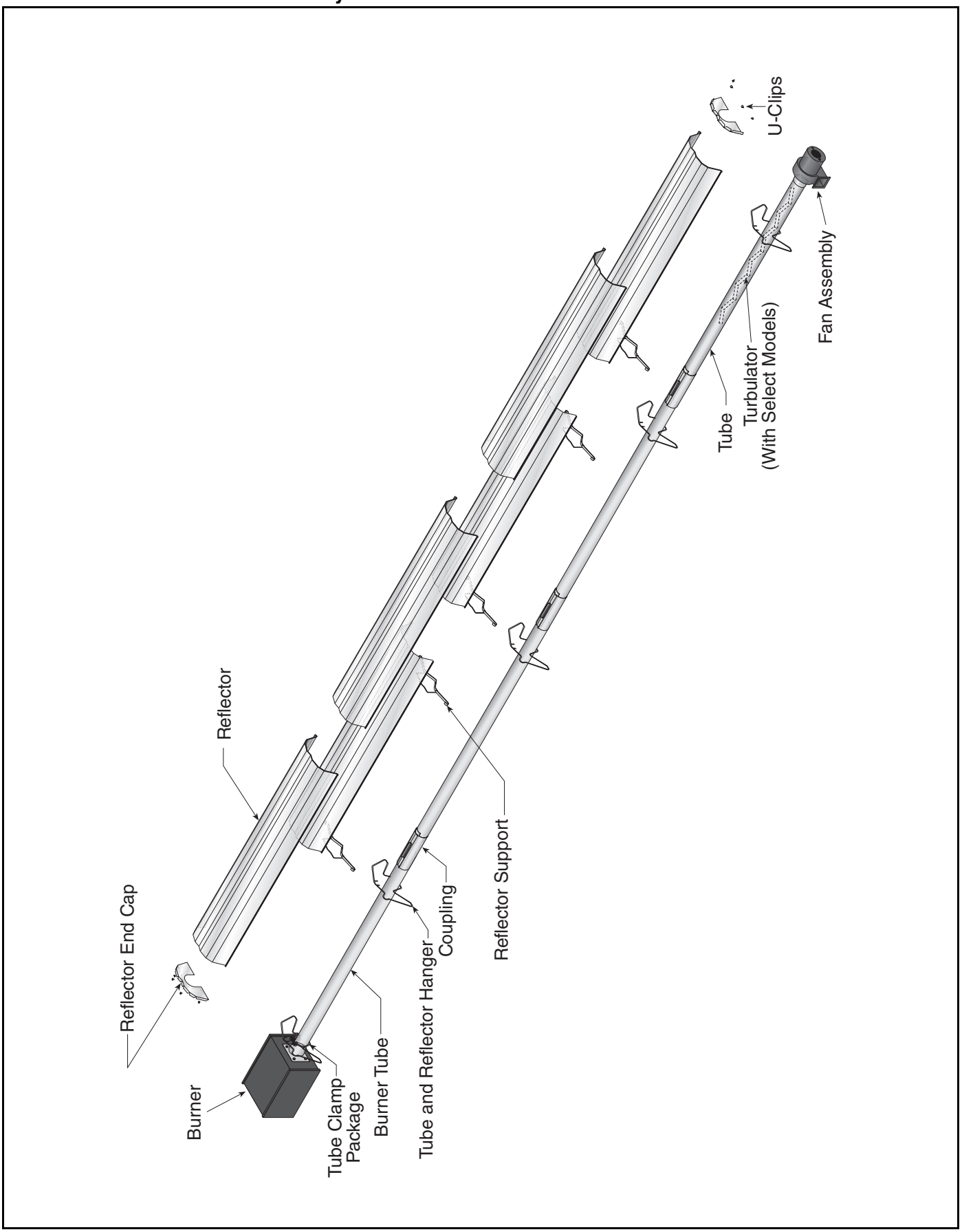


FIGURE 14: Unitary Linear Layout Overviews

LEGEND

- Burner
- Reflector
- Tube
- Tube/Reflector Hanger
- Coupling Assembly
- Fan Assembly

a = 14" (36 cm)
reflector width (not shown)

b = 2" (5 cm)
end cap to burner/fan

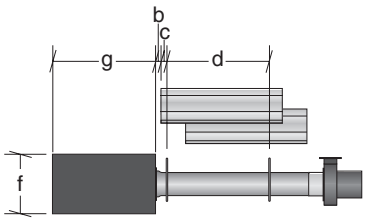
c = 2" (5 cm)
end cap to hanger

d = 7'6" (229 cm)
distance first hanger

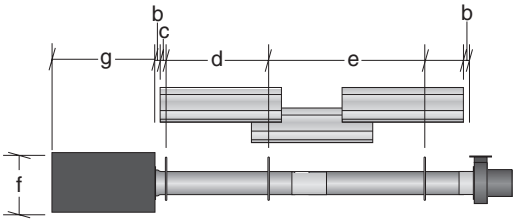
e = 10' (305 cm)
distance between hangers

f = 9.5" (24 cm)
burner height

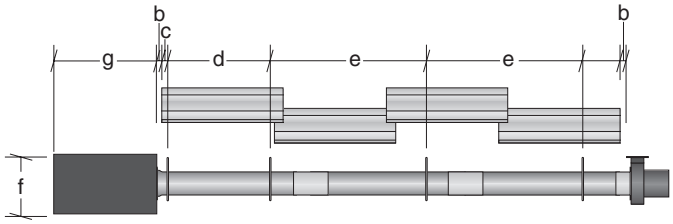
g = 17.5" (44 cm)
burner length



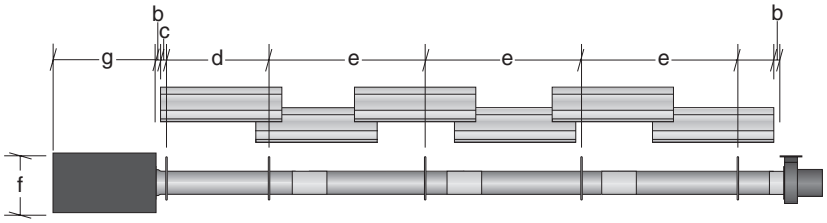
10' (3 m) Tube Length



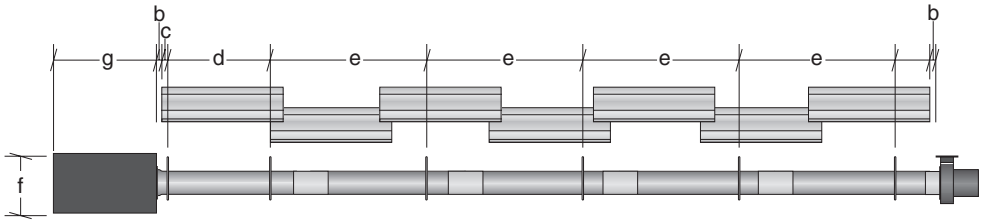
20' (6 m) Tube Length



30' (9 m) Tube Length

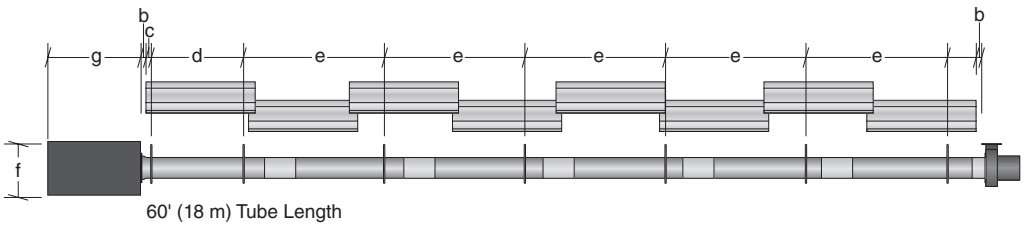


40' (12 m) Tube Length

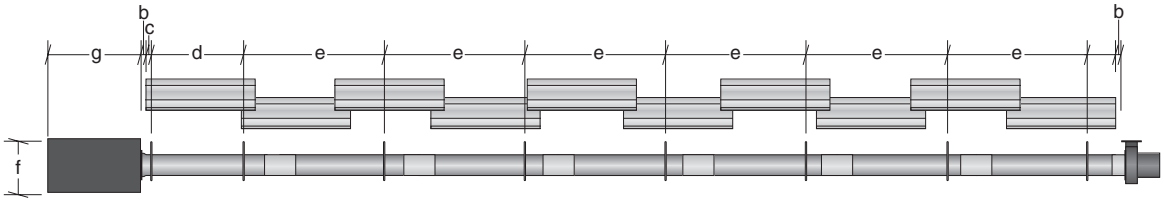


50' (15 m) Tube Length

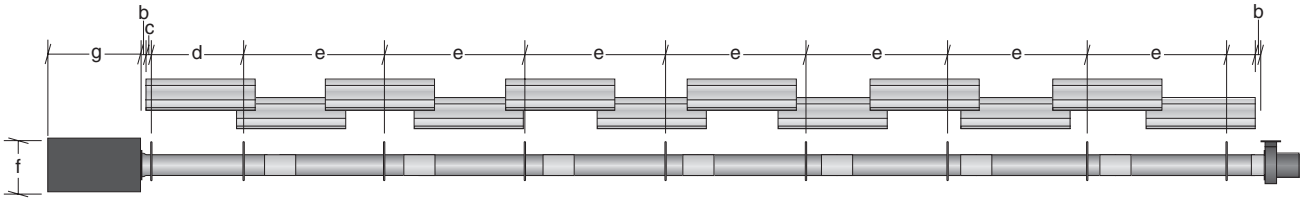
FIGURE 15: Unitary Linear Layout Overviews (Continued)



60' (18 m) Tube Length



70' (21 m) Tube Length



80' (24 m) Tube Length

8.4 Unitary U-tube Heater Layouts

CTHN-Series heaters (except CTHN-40) are approved for optional u-tube configurations.

The u-tube may be installed in either a standard horizontal position, 45° position or in an opposite 45° position as shown *on Page 5, Figure 5 through Figure 7*. When using a u-tube configuration, the following additional rules must be adhered to:

- A minimum of 10' (3 m) on CTHN-60/80, a minimum of 15' (4.5 m) on CTHN-100/125, and a minimum of 20' (6 m) on CTHN-150/175/200 is required between the burner and the u-tube.
- For turbulator installation, *See Page 21, Step 8.8*.
- The burner must never be operated in a tilted position.

The heater must be properly supported at all locations. *See Page 10, Figure 12*.

FIGURE 16: U-tube Assembly Overview

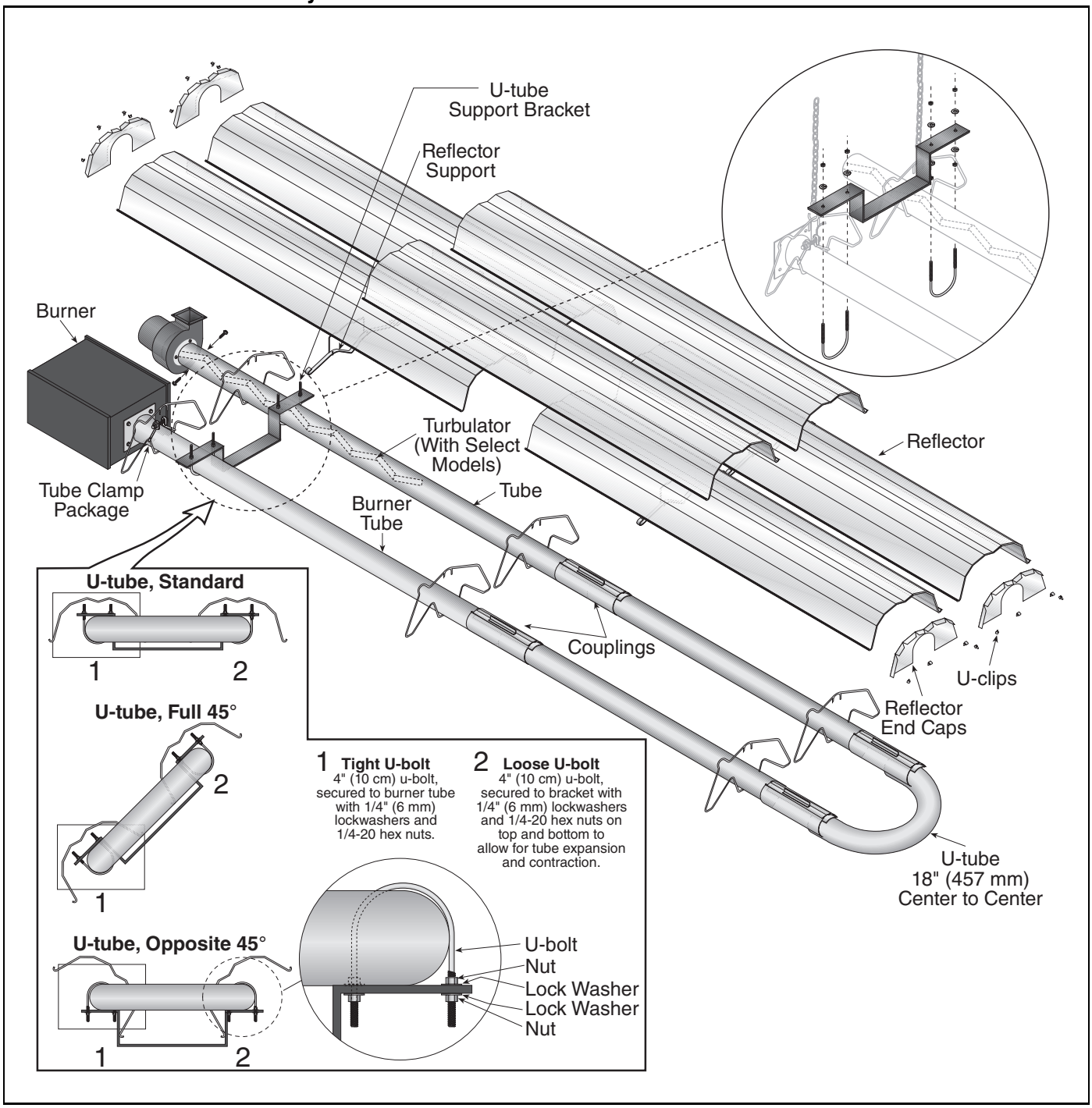
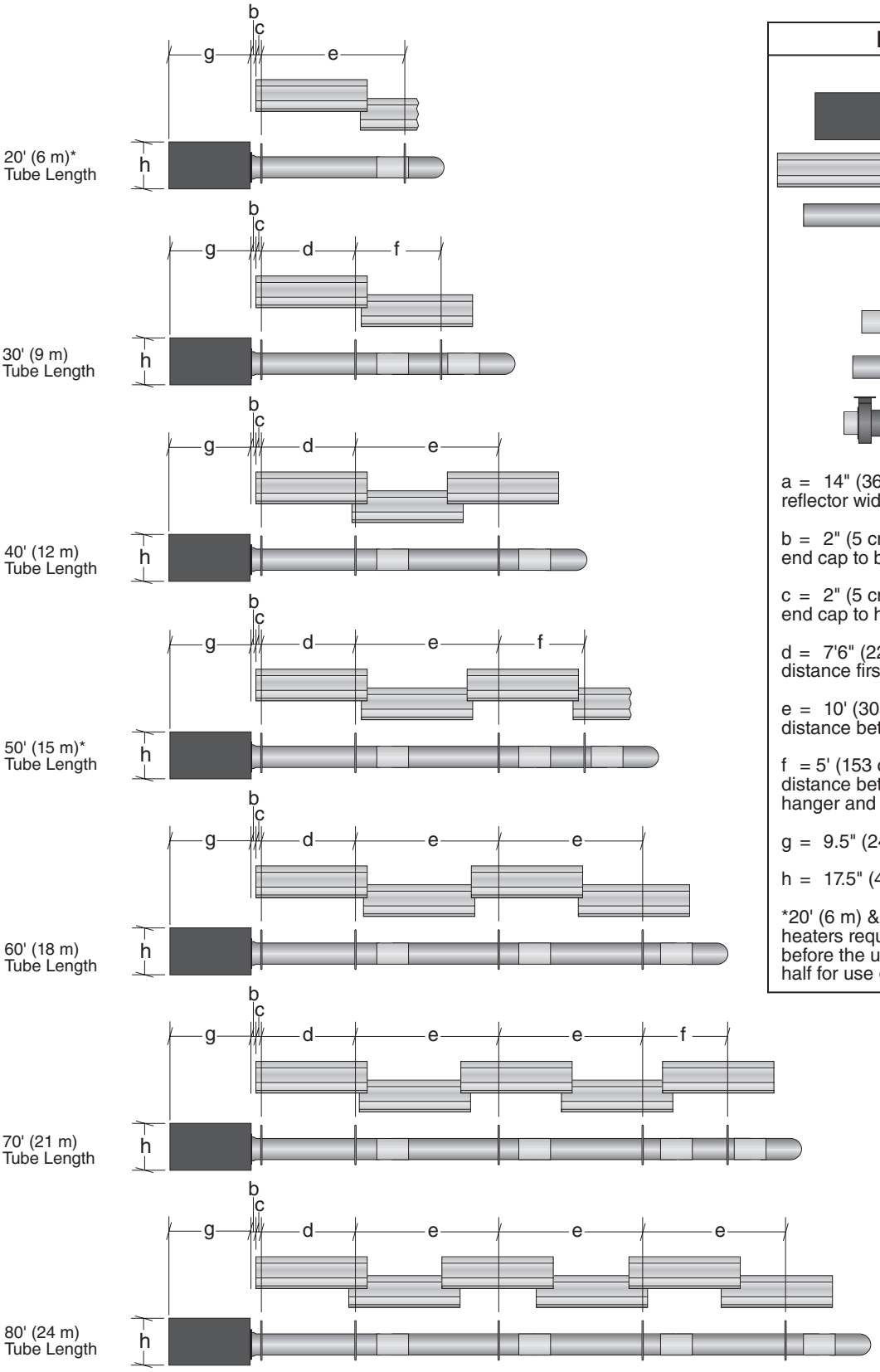
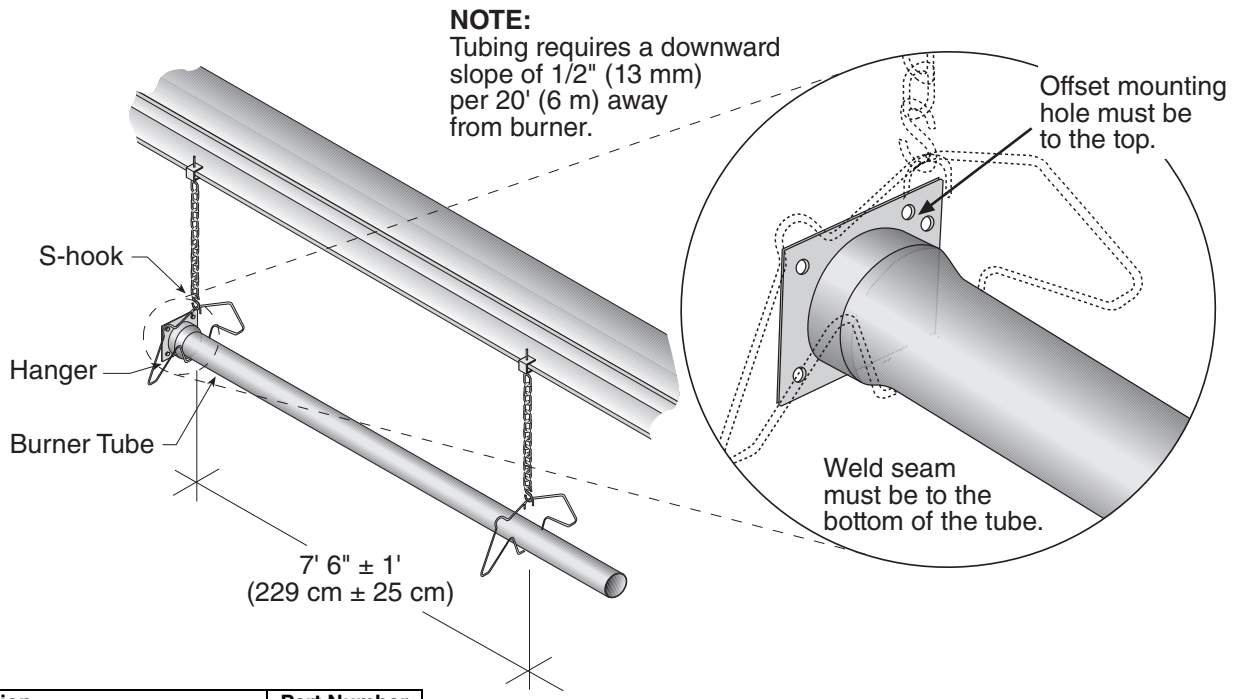


FIGURE 17: Unitary U-tube Layout Overviews



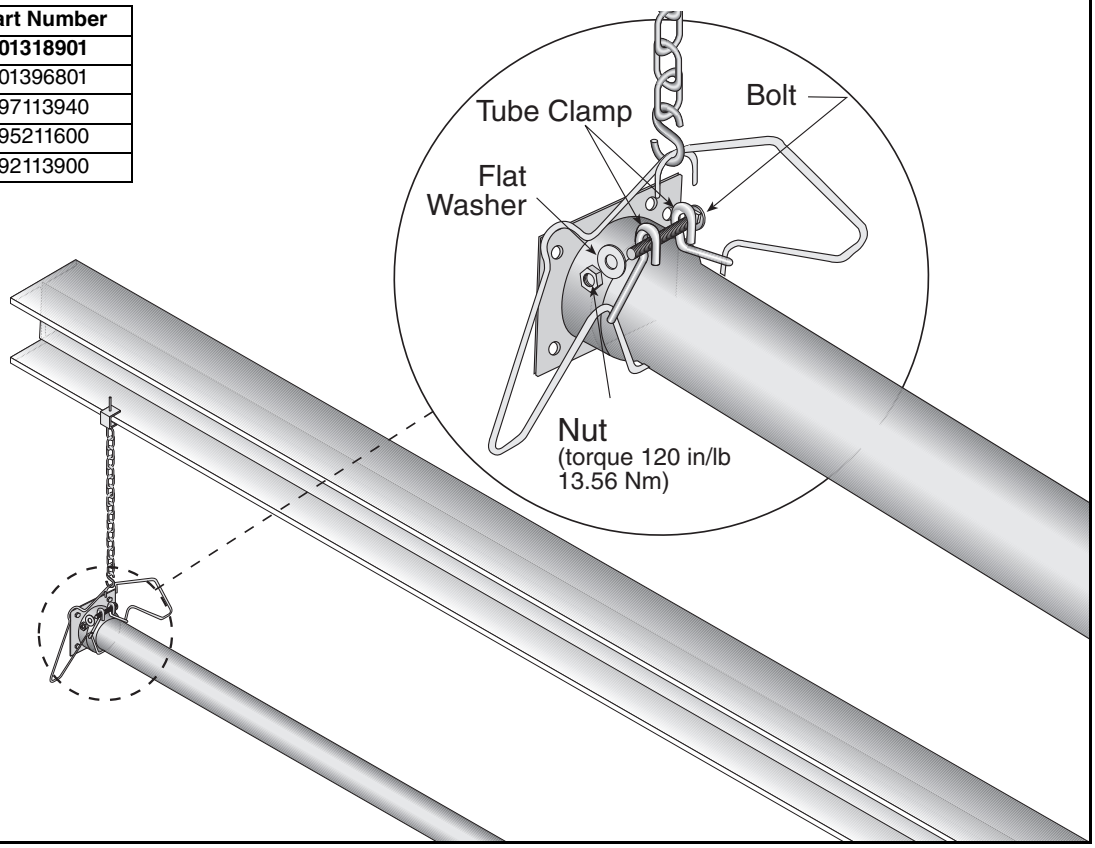
Step 8.5 Burner Tube Installation


NOTE:
Tubing requires a downward slope of 1/2" (13 mm) per 20' (6 m) away from burner.
Offset mounting hole must be to the top.
S-hook
Hanger
Burner Tube
Weld seam must be to the bottom of the tube.
7' 6" ± 1'
(229 cm ± 25 cm)

Description	Part Number
Burner Tube	03051XXX
S-hook	91907302
Tube/Reflector Hanger	03090100

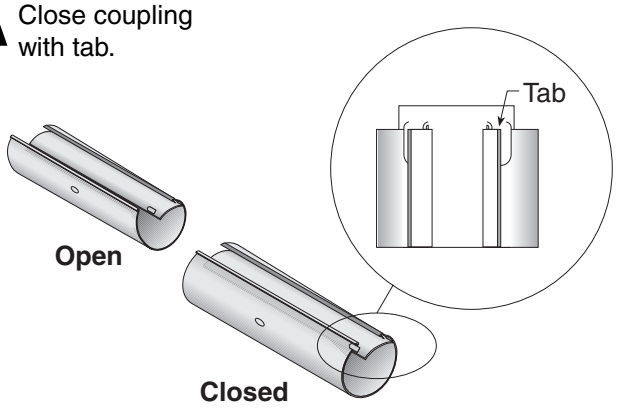
Step 8.6 Tube Clamp Package Installation

Description	Part Number
Tube Clamp Package	**01318901**
Tube Clamp	01396801
Bolt	97113940
Flat Washer	95211600
Nut	92113900

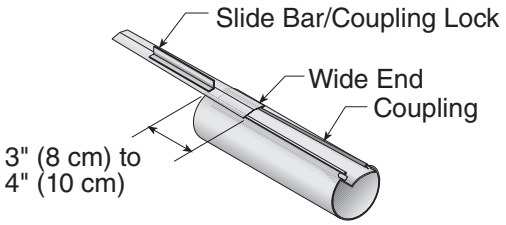


Step 8.7 Coupling and Tube Assembly

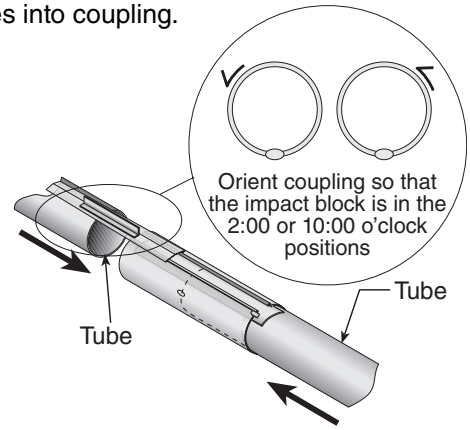
A Close coupling with tab.



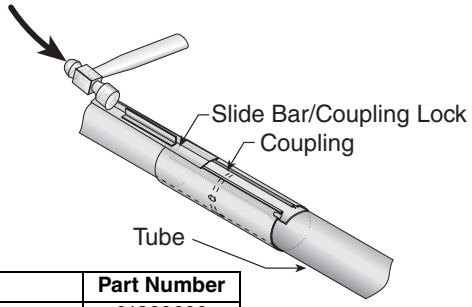
B Start slide bar/coupling lock onto coupling.



C Insert tubes into coupling.



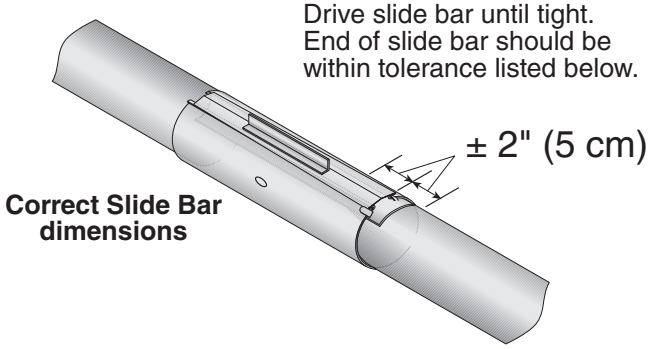
D Tighten coupling to join tubes.

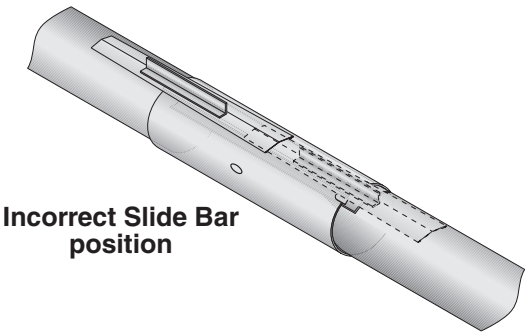


Description	Part Number
Coupling	01329600
Slide Bar/Coupling Lock	01329700
Tube	91409XXX

Step 8.7.1 Coupling and Tube Assembly (Continued)

Tighten slide bar as shown below.

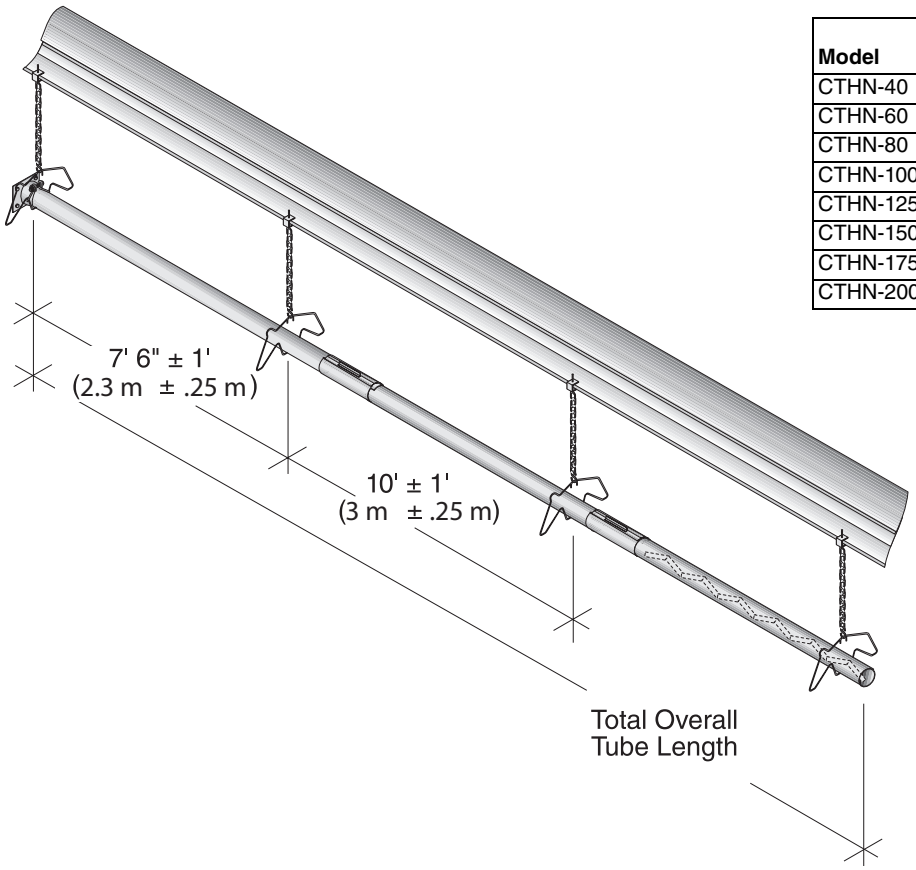




- **Repeat Step 8.7, A - D until all tubes are assembled.** *See Page 21, Step 8.7.2***.**

NOTE: If coupling is not tight, loss of vacuum can occur.

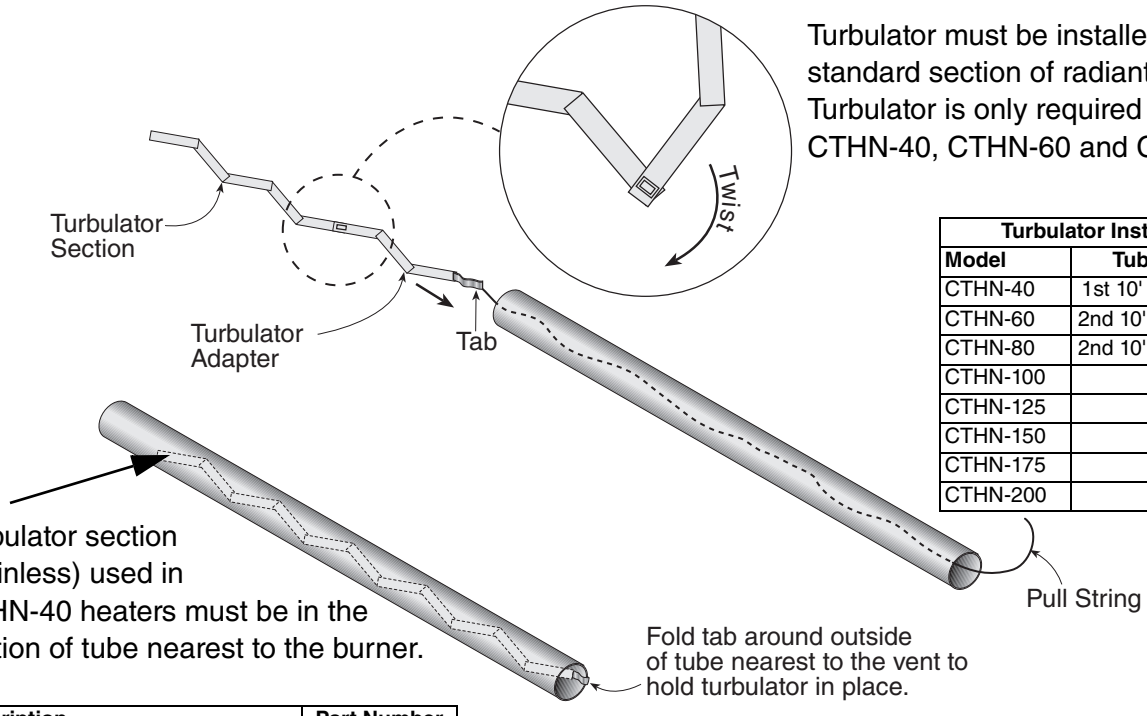
Step 8.7.2 Coupling and Tube Assembly (Continued)



Model	Radiant Tube Length
CTHN-40	10' (4.5 m)
CTHN-60	20' (6 m)
CTHN-80	20' (6 m)
CTHN-100	30' (9 m)
CTHN-125	40' (12 m)
CTHN-150	40' (12 m)
CTHN-175	50' (18 m)
CTHN-200	50' (18 m)

Step 8.8 Turbulator Installation

Turbulator must be installed in the last standard section of radiant tube. Turbulator is only required on the CTHN-40, CTHN-60 and CTHN-80.

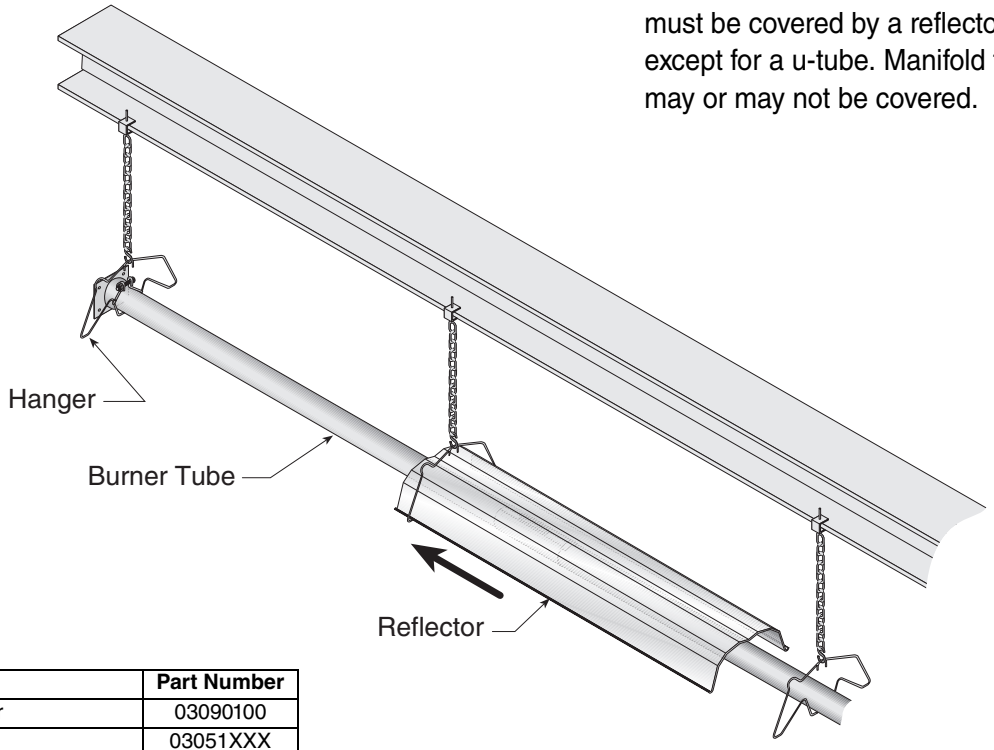


Turbulator Installation	
Model	**Tube Section**
CTHN-40	1st 10' (3 m) Section
CTHN-60	2nd 10' (3 m) Section
CTHN-80	2nd 10' (3 m) Section
CTHN-100	N/A
CTHN-125	N/A
CTHN-150	N/A
CTHN-175	N/A
CTHN-200	N/A

Description	Part Number
Turbulator Adapter	03051503
Turbulator Section	03051504
Turbulator Section (Stainless)	03051505
Tube	91409XXX

Step 8.9 Reflector Installation

NOTE: All radiant tube surfaces must be covered by a reflector, except for a u-tube. Manifold tube may or may not be covered.



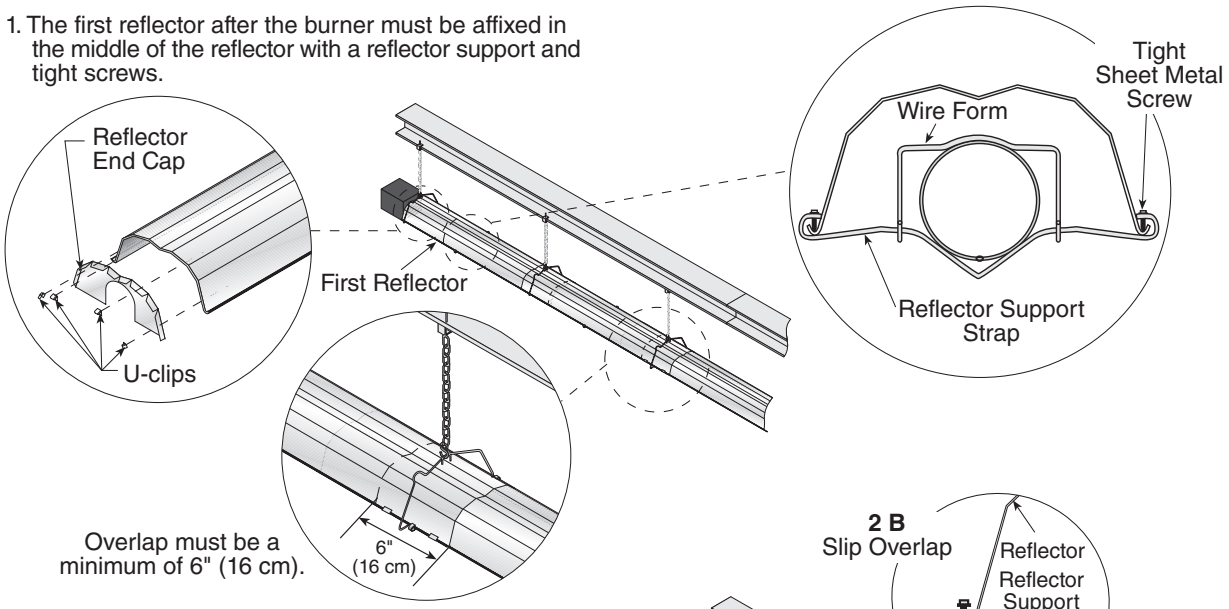
Description	Part Number
Tube/Reflector Hanger	03090100
Burner Tube	03051XXX
Reflector	02750303

Step 8.9.1 Reflector, U-clip and Reflector Support Installation

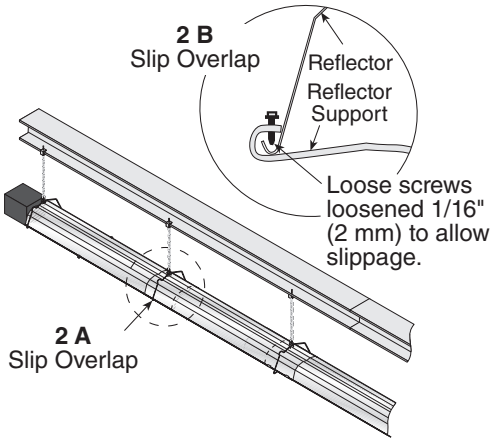
The pictorial drawings of the heater construction in *Section 8* are schematic only and provide a general guideline of where hangers, reflector supports and u-clips are to be installed.

To ensure proper expansion and contraction movement of the reflectors, a combination of u-clips and reflector supports are used. The positioning of reflector supports and u-clips depend on the individual installation. Use either pop rivets or sheet metal screws instead of u-clips when installing end caps and joint pieces in areas where impact and high wind may be a factor. The following rules must be observed.

1. The first reflector after the burner must be affixed in the middle of the reflector with a reflector support and tight screws.

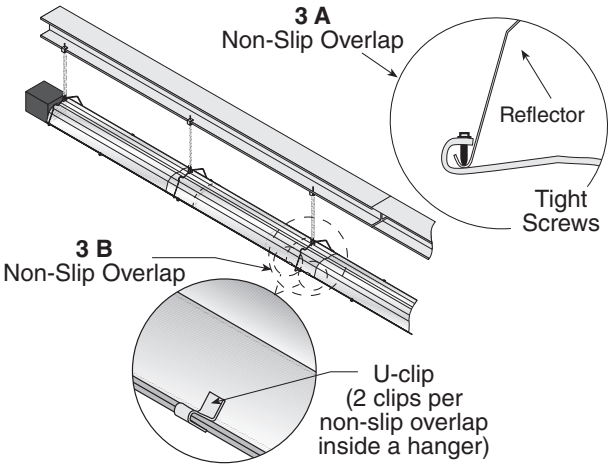


2. The overlap at the first and second reflector is a **slip overlap.** Thereafter, every third reflector joint is a slip overlap. A slip overlap is achieved by either:
   a.) both reflectors lay inside a hanger. (No reflector support needed.)
   b.) using a reflector support with loose screws at the reflector overlap.



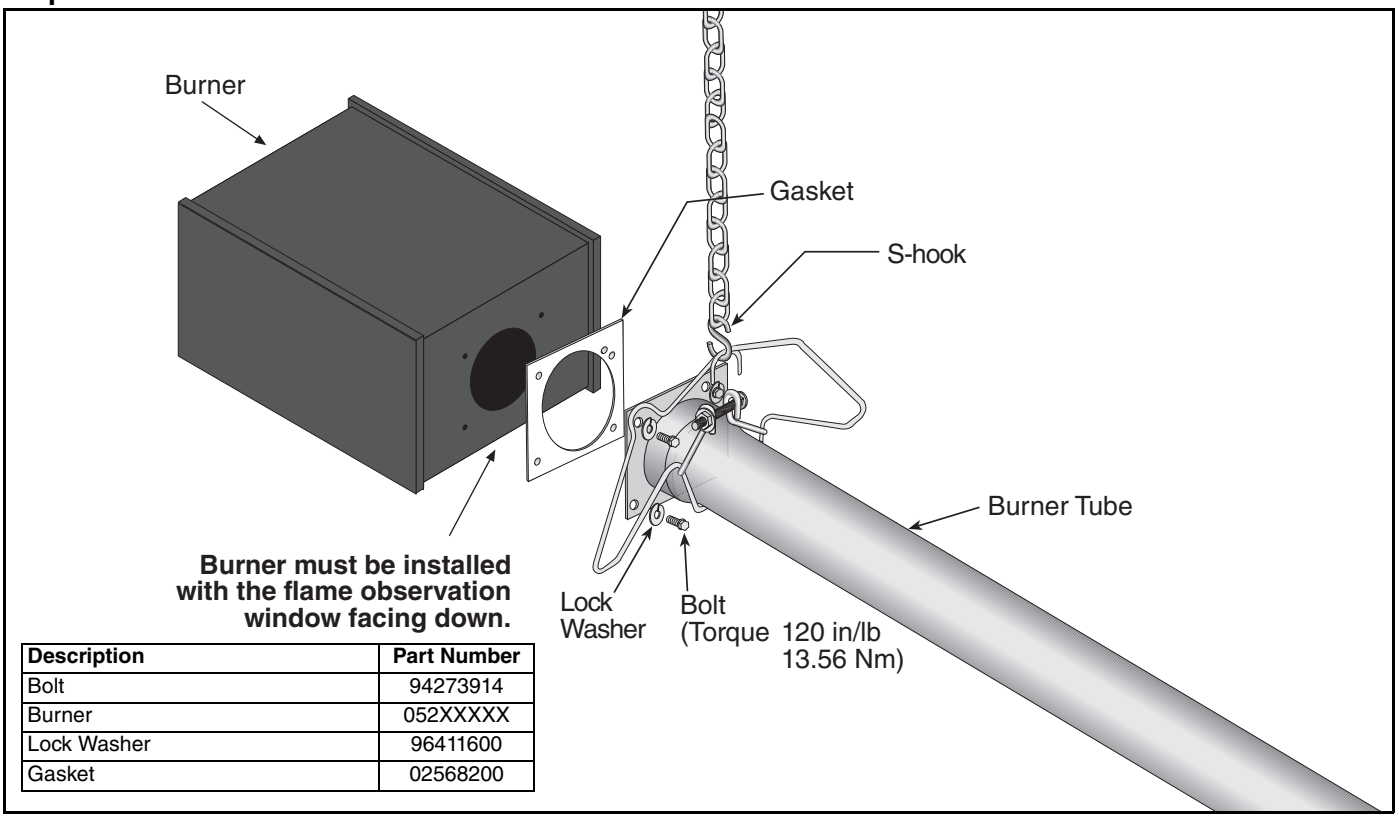
3. The remaining reflector overlaps require a **non-slip overlap** connection. To affix the reflectors together in a non-slip overlap either:
   a.) use reflector support and tight screws.
   b.) if both reflectors lay inside a hanger, u-clips or sheet metal screws may be used.

   This section of three reflectors joined together must be affixed to the tube with at least one reflector support with tight screws.



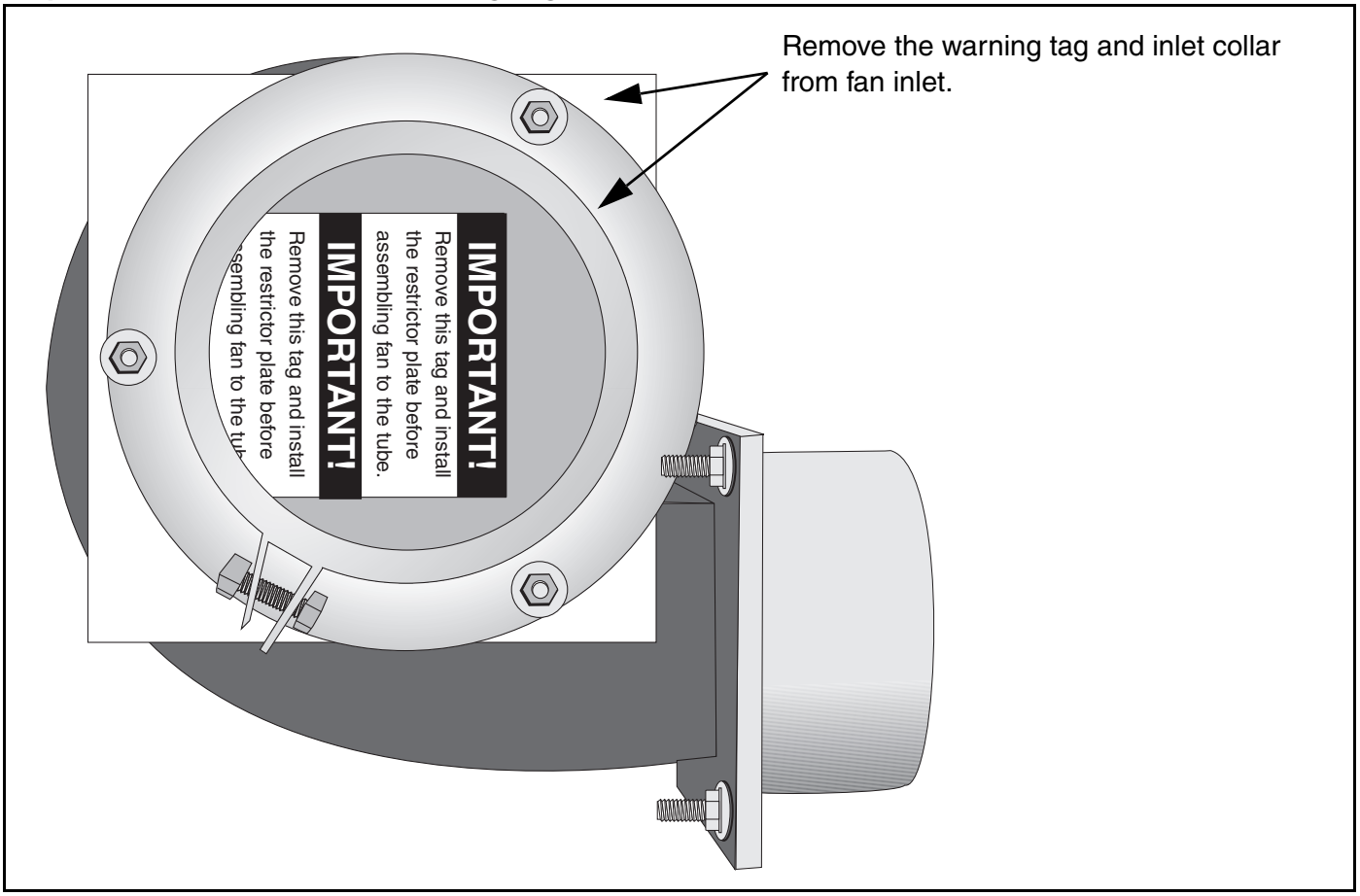
Description	Part Number
Reflector Support Package	**03050010**
Wire Form	91908004
Reflector Support Strap	03050000
Screw #8 x 3/4	94320812
U-clip Package	91107720
Reflector End Cap	027508XX

Step 8.10 Burner Installation



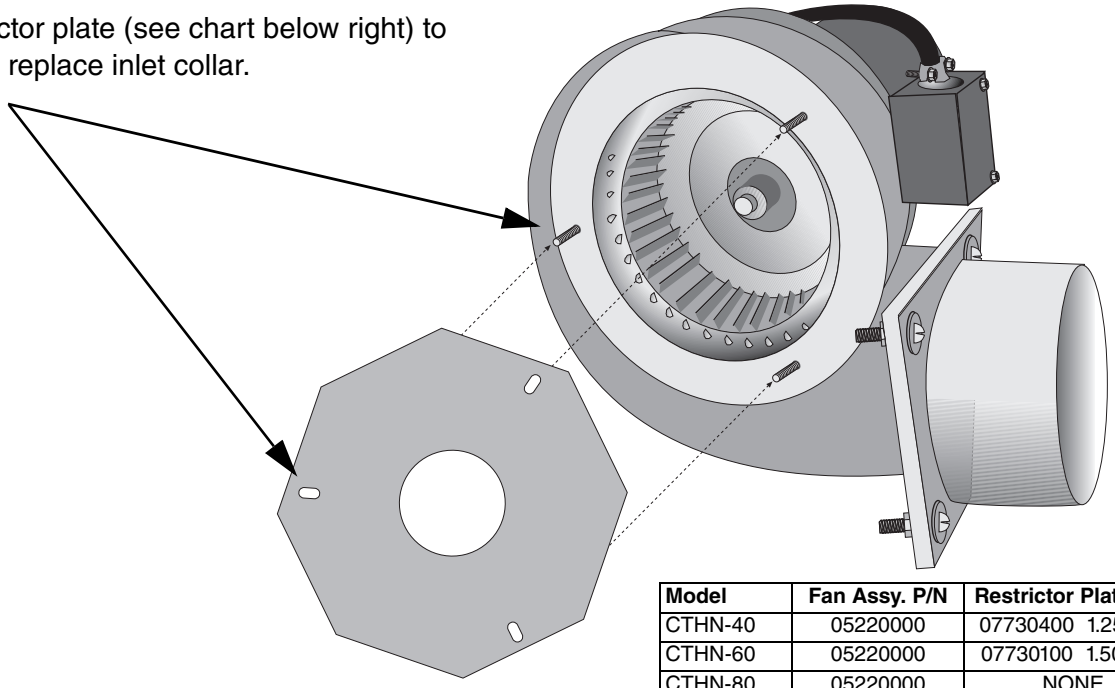
Description	Part Number
Bolt	94273914
Burner	052XXXXX
Lock Washer	96411600
Gasket	02568200

Step 8.11 Fan Inlet Plate and Warning Tag


Remove the warning tag and inlet collar from fan inlet.
IMPORTANT!
Remove this tag and install the restrictor plate before assembling fan to the tube.
IMPORTANT!
Remove this tag and install the restrictor plate before

Step 8.12 Restrictor Plate Installation

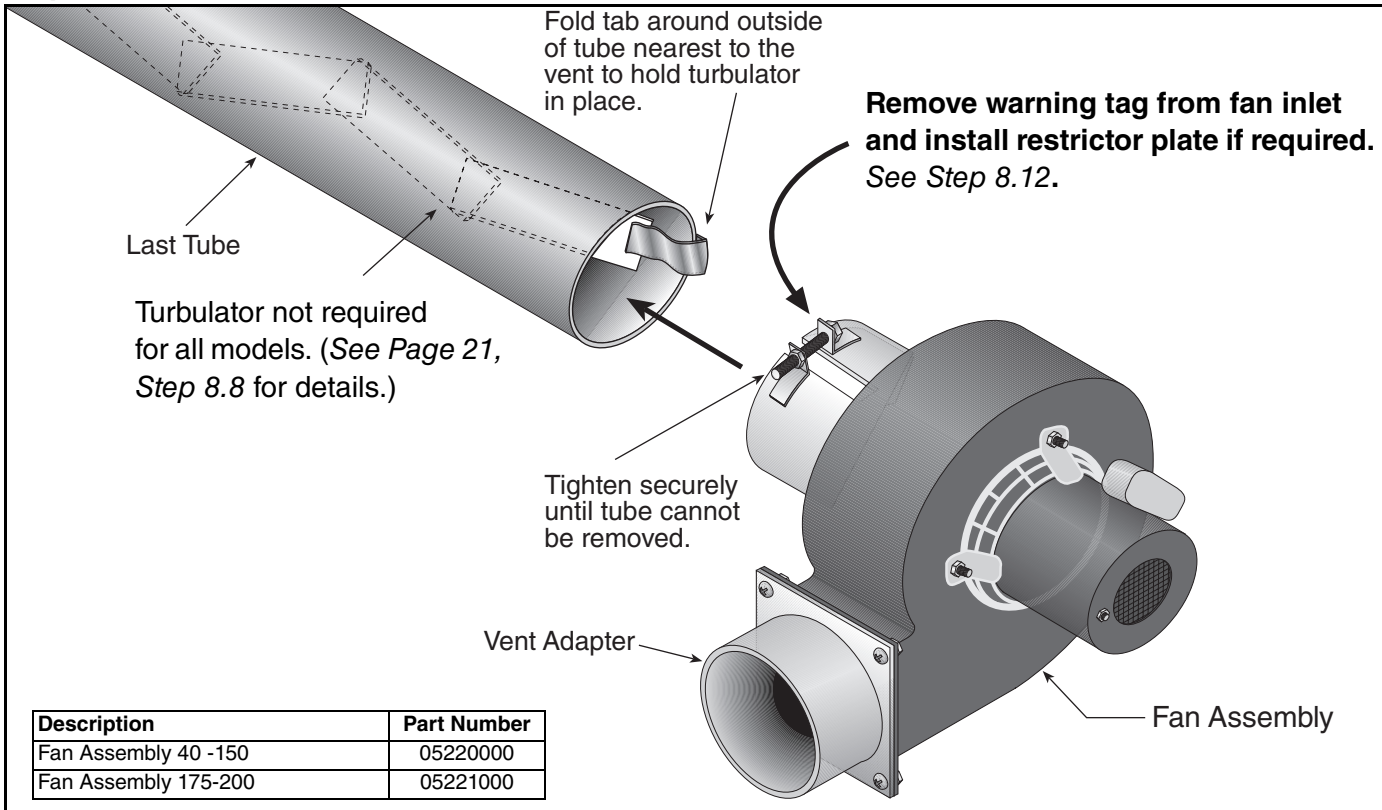
Attach restrictor plate (see chart below right) to fan inlet and replace inlet collar.



Description	Part Number
Restrictor Plate	07730XXX

Model	Fan Assy. P/N	Restrictor Plate P/N
CTHN-40	05220000	07730400 1.25" dia
CTHN-60	05220000	07730100 1.50" dia
CTHN-80	05220000	NONE
CTHN-100	05220000	07730500 2.25" dia
CTHN-125	05220000	07730500 2.25" dia
CTHN-150	05220000	07730700 2.75" dia
CTHN-175	05221000	07730600 2.50" dia
CTHN-200	05221000	NONE

Step 8.13 Fan Installation


Fold tab around outside of tube nearest to the vent to hold turbulator in place.
Remove warning tag from fan inlet and install restrictor plate if required. See Step 8.12.
Last Tube
Turbulator not required for all models. (See Page 21, Step 8.8 for details.)
Tighten securely until tube cannot be removed.
Vent Adapter
Fan Assembly

Description	Part Number
Fan Assembly 40 -150	05220000
Fan Assembly 175-200	05221000

SECTION 9: MULTIBURNER HEATER INSTALLATION

9.1 Standard Parts

Table 6: Contents of CTHN Burner Carton

Part No.	Description	CTHN-40	CTHN-60	CTHN-80	CTHN-100	CTHN-125	CTHN-150	CTHN-175	CTHN-200
052XXXXX	Burner (Rate and Fuel Varies)	1	1	1	1	1	1	1	1
07730400	Restrictor Plate 1.25" (3.2 cm) dia.	1	-	-	-	-	-	-	-
07730100	Restrictor Plate 1.50" (3.8 cm) dia.	-	1	-	-	-	-	-	-
07730500	Restrictor Plate 2.25" (5.7 cm) dia.	-	-	-	1	1	-	-	-
07730600	Restrictor Plate 2.50" (6.4 cm) dia.	-	-	-	-	-	-	1	-
07730700	Restrictor Plate 2.75" (7 cm) dia.	-	-	-	-	-	1	-	-
03051503	Turbulator Adapter	1	1	1	-	-	-	-	-
03051504	Turbulator Section	2	4	4	-	-	-	-	-
03051505	Turbulator Section, Stainless Steel	1	-	-	-	-	-	-	-
*91412200	Flexible Stainless Steel Gas Hose , 1/2" NPT (US Models Only)	1	1	1	1	1	-	-	-
*91412203	Flexible Stainless Steel Gas Hose , 3/4" NPT (US Models Only)	-	-	-	-	-	1	1	1
02568200	Gasket (Burner to Burner Tube)	1	1	1	1	1	1	1	1
94273914	Hex Head Cap Screw 5/16" -18 x 7/8"	4	4	4	4	4	4	4	4
96411600	Split Lock Washer	4	4	4	4	4	4	4	4
91201708	Pipe Nipple 1/2" NPT x 4"	1	1	1	1	1	1	1	1
152101NA	Installation, Operation and Service Manual	1	1	1	1	1	1	1	1

*Canadian Models: Rubber (Type 1) Gas Hoses available as an accessory. *See Page 69, Section 16*.

Table 7: Contents of Core and Extension Packages

		Core Packages							Extension Packages							
		Hot Rolled			Aluminized				Hot Rolled				Aluminized			
Part No.	Description	20' (6m)	30' (9m)	40' (12m)	10' (3m)	20' (6m)	30' (9m)	40' (12m)	10' (3m)	20' (6m)	30' (9m)	40' (12m)	10' (3m)	20' (6m)	30' (9m)	40' (12m)
91409300	Tube, Hot Rolled Steel, 10' (3 m)	1	2	3	-	-	-	-	1	2	3	4	-	-	-	-
91409408	Tube, HT Aluminized, 10' (3 m)	-	-	-	-	1	2	3	-	-	-	-	1	2	3	4
03051101	Burner Tube, ALUMI-THERM® Steel, 10' (3 m)	-	1	1	-	-	1	1	-	-	-	-	-	-	-	-
03051601	Burner Tube, HT ALUMI-THERM® Steel, 10' (3 m)	1	-	-	1	1	-	-	-	-	-	-	-	-	-	-
01312700	Coupling Assembly	1	2	3	-	1	2	3	1	2	3	4	1	2	3	4
02750303	Standard Reflector, 8' (2.4 m)	3	4	6	2	3	4	6	2	3	4	6	2	3	4	6
02750800	End Cap	2	2	2	2	2	2	2	-	-	-	-	-	-	-	-
03090100	Tube and Reflector Hanger	3	4	5	2	3	4	5	1	2	3	4	1	2	3	4
91907302	S-hook	3	4	5	2	3	4	5	1	2	3	4	1	2	3	4
03050010	Reflector Support Package (Strap, Wire Form, Screws)	2	3	5	1	2	3	5	2	3	4	6	2	3	4	6
91107720	U-clip Package	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
90502700	Vent Adapter (Not used on CTHN)	1	1	1	1	1	1	1	-	-	-	-	-	-	-	-
01318901	Tube Clamp Package	1	1	1	1	1	1	1	-	-	-	-	-	-	-	-

Table 8: Component Package Guide

Model	Tubing Length	Core Packages	
	Minimum	Standard	Aluminized
CTHN-40	20' (6 m)	CP20HRS	CP10ALUM
CTHN-60	30' (9 m)	CP30HRS	CP20ALUM
CTHN-80	30' (9 m)	CP30HRS	CP20ALUM
CTHN-100	40' (12 m)	CP40HRS	CP30ALUM
CTHN-125	50' (15 m)	CP30HRS + EXP20HRS	CP40ALUM
CTHN-150	50' (15 m)	CP30HRS + EXP20HRS	CP40ALUM
CTHN-175	60' (18 m)	CP30HRS + EXP30HRS	CP30ALUM + EXP30ALUM
CTHN-200	60' (18 m)	CP30HRS + EXP30HRS	CP30ALUM + EXP30ALUM

Additional tubing length may be added to heater.
Any additional tubing lengths are considered as manifold tube length for length determination, *See Page 29, Section 9.2 through Page 31, Section 9.6*, design requirements and allowed manifold tube lengths.
For manifold tubing on multiburner systems, heat-treated aluminized or porcelain coated tubing is required.

Table 9: Common CTHN-Series Components

Part No.	Description
Tubing and Related Accessories	
01312700	Coupling, 4" (10 cm) Plain
01312706	Coupling, 6" (15 cm) Plain
0131270I	Coupling, 4" (10 cm) Lined
01331900	Coupling, 4" (10 cm) Damper
E0009356	Coupling, 6" (15 cm) Damper
0133022D	Tee, 4" (10 cm) Coated
01330203	Tee, 4" (10 cm) Aluminized
01330204	Tee, 6" (15 cm) Aluminized
0133092D	Cross, 4" (10 cm) Coated
01330903	Cross, 4" (10 cm) Aluminized
01330904	Cross, 6" (15 cm) Aluminized
01335801	Elbow, 4" (10 cm) Aluminized 90°
T0100320	Elbow, 6" (15 cm) Aluminized 90°
0133580D	Elbow, 4" (10 cm) Coated 90°
01336101	Elbow, 4" (10 cm) Aluminized 45°
0133610D	Elbow, 4" (10 cm) Coated 45°
91409300	Tube, 4" (10 cm) dia Hot Rolled Steel 10' (3 m)
91409403	Tube, 4" (10 cm) dia Non-Heat Treated Aluminized 10' (3 m)
91409408	Tube, 4" (10 cm) dia Heat Treated Aluminized 10' (3 m)
91409420	Tube, 6" (15 cm) dia Non-Heat Treated Aluminized 10' (3 m)
9141030D	Tube, 4" (10 cm) dia Coated 10' (3 m)
E0009105	Tube, 6" (15 cm) dia 10' (3 m) Heat Treated Aluminized
91418200	Tube Adapter, 6" (15 cm) dia x 4"(10 cm) dia Aluminized
91240010	Tube Hanger, 6" (15 cm)
91308001	Pipe Compound, High Temperature 1lb can

Venting Accessories	
01324401	Air Supply Takeoff, 4" (10 cm) Outside
90707501	Air Supply Blower/Power Venter
91409601	Air Flex Duct, 4" (10 cm) Outside (Box of 8 - 8' (2.4 m) sections)

Reflectors and Related Accessories	
01329910	Reflector Side Extension Support
03050010	Reflector Support Package (Tubing)
02712700	Reflector Side Extension, 2 Clips, 2 Screws
02750303	Reflector, Aluminum
027503SS	Reflector, Stainless Steel
02750800	Reflector End Cap, Aluminum
027508SS	Reflector End Cap, Stainless Steel
027508SH	Reflector End Cap, Stainless Steel with Hole
02750900	Reflector Joint
027509SS	Reflector Joint, Stainless Steel
027127SS	Reflector Side Extension, Stainless Steel
03090100	Tube and Reflector Hanger
91907302	S-hook
91903201	Turnbuckle
91903300	Spring Hook
91903202	Turnbuckle with Eyebolt

Thermostats	
02770002	System Control
05023000	Load Relay Package
90417600	Transformer Relay - SPST (12 A)
90436300	Transformer Relay - DPST (12 A)
90423000	Thermostat, 24 V Low Voltage (Marked 1-5)
90424300	Thermostat Guard

Deco Grille (1' x 8' [.3 m x 2.4 m])	
01363003	Bracket
01365901	End Piece

01326801	Reinforcement
01365903	Joint Piece
91406700	1' x 8' (.3 m x 2.4 m) Protective Grille

Deco Grille (2' x 4' [.6 m x 1.2 m])	
01365900	Shield Frame
01370408	Reflector Side Extension 8" x 48" (20 cm x 122 cm)
01370412	Reflector Side Extension 12" x 48" (30 cm x 122 cm)
01370416	Reflector Side Extension 16" x 48" (40 cm 122 cm)
91407000	Grille, Aluminum 2' x 4' (.6 m x 1.2 m)

Protective Grille	
08050001	Grille, 40" (102 cm) Protective
08050002	Protective Grille End Cap

Fan and Pump Packages	
05220000	Fan Package 40-150
05221000	Fan Package 175-200
02719105	**EP-100 Pump Package**
02719100	EP-100 Pump
02724700	Accessory Package
02716305	**EP-201 Pump Package**
01312001	EP-201 Pump
01317805	Accessory Package
02712034	**EP-203 Pump Package**
01312002	EP-203 Pump
01317805	Accessory Package
02723014	**EP-301 Pump Package 4"** (10 cm)
02730101	EP-301 Pump Assembly
02730104	Accessory Package
02723016	**EP-301 Pump Package 6"** (15 cm)
02730101	EP-301 Pump Assembly
02730106	Accessory Package
02723034	**EP-303 Pump Package 4"** (10 cm)
02730103	EP-303 Pump Assembly
02730104	Accessory Package
02723036	**EP-303 Pump Package 6"** (15 cm)
02730103	EP-303 Pump Assembly
02730106	Accessory Package

Pump Accessories	
90430600K	Pressure Switch

Starters and Contactors	
10050001	Starter, 120 Vac for EP-203, 3 Ø
10050003	Starter, 120 Vac for EP-201, 1 Ø
10050008	Starter, 120 Vac for EP-301, 1 Ø
10050009	Contactor Package- 120 Vac Coil for EP-301, 230 V, 2 HP
10050010	Starter, 120 Vac for EP-303, 3 Ø

9.2 Multiburner System Design Requirements

A CTHN multiburner system has a number of radiant tube sections interconnected by manifold tube to a pump to form a complete system. Reflectors can be used over the manifold tube but are not required. The system design parameters are such that the manifold sections are not subjected to condensate when the system is fully heated up. It is required that heat-treated aluminized or coated tubing is used for the manifold to increase system life and to handle initial condensation during start-up. Damper couplings may be necessary to balance system vacuum.

Design requirements for a CTHN multiburner system are summarized *on Page 30, Table 10*.

CTHN multiburner heaters are typically shipped as burner packages and tube and accessory packages. The tube and accessory packages contain enough tube, reflector and hanging parts for the radiant section of one CTHN heater. Elbows, tees, manifold tube, pumps, controls, damper couplings and any other parts used beyond the burner, radiant tube and reflector must be purchased separately. See *Figure 18* for a general overview of a simple CTHN multiburner system. Depending on system requirements, CTHN multiburner systems may be controlled by either a ROBERTS GORDON® System Control (shown) or by a relay system.

FIGURE 18: Typical CTHN Multiburner System Installation

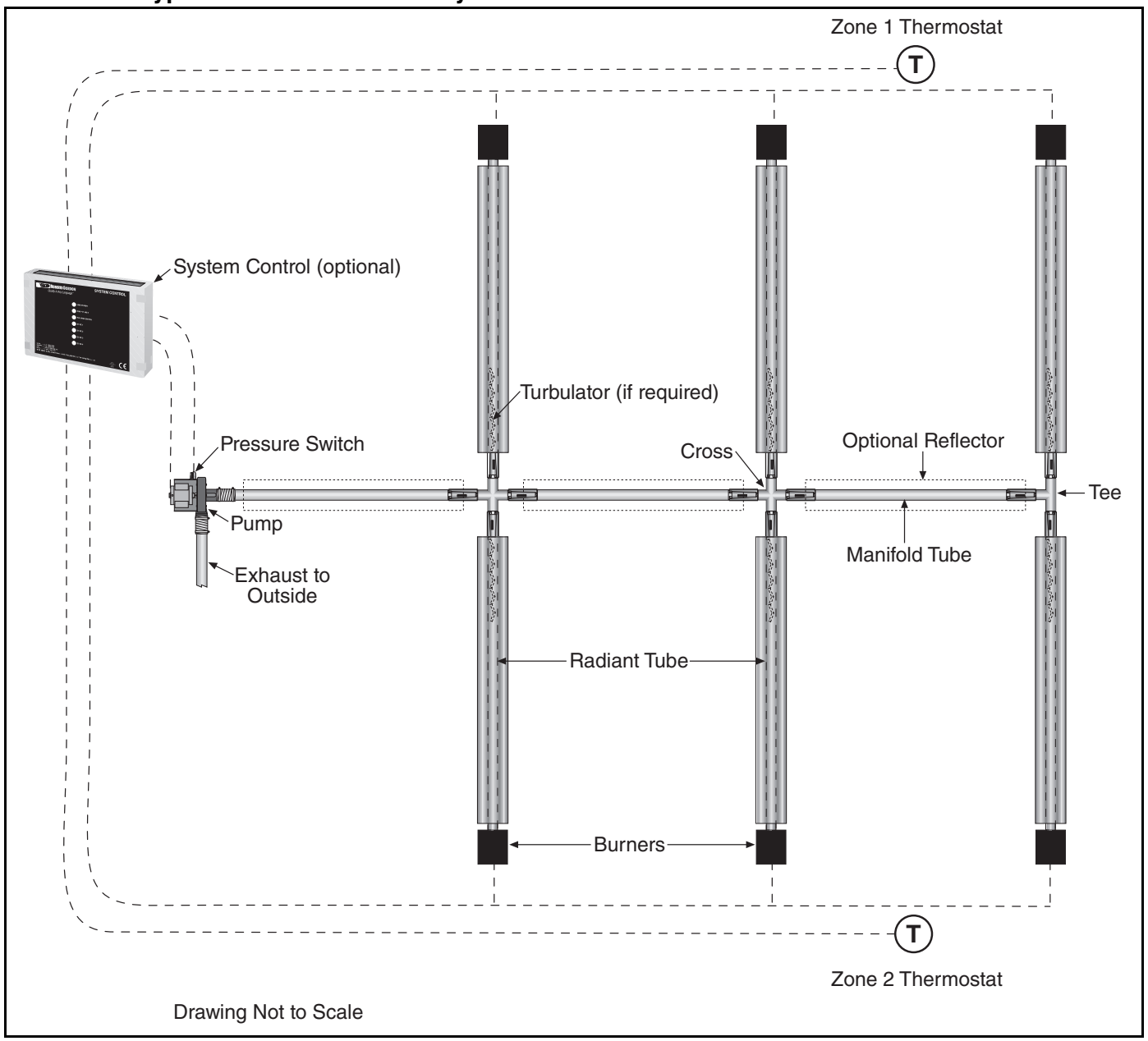


Table 10: Multiburner Design Requirements

Burner Model:	CTHN-40	CTHN-60	CTHN-80	CTHN-100	CTHN-125	CTHN-150	CTHN-175	CTHN-200
Radiant Tube Length	20' (6 m)	30' (9 m)	30' (9 m)	40' (12 m)	50' (15 m)	50' (15 m)	60' (18 m)	60' (18 m)
Minimum Manifold Tube Length per Burner	3' (1 m)	3' (1 m)	3' (1 m)	6' (2 m)	6' (2 m)	10' (3 m)	10' (3 m)	10' (3 m)
Maximum Manifold Tube Length per Burner	30' (9 m)	35' (10.5 m)	40' (12 m)	45' (13.5 m)	50' (15 m)	55' (16.5 m)	60' (18 m)	60' (18 m)
Minimum Distance from Burner to Elbow or U-tube	10' (3 m)	10' (3 m)	10' (3 m)	15' (4.5 m)	15' (4.5 m)	20' (6 m)	20' (6 m)	20' (6 m)
Elbows Allowed per Burner*	2	2	2	2	2	2	2	2

* U-tube = 2 elbows

9.3 Burners Per Pump

1. The maximum number of burners per pump is shown in *Table 11*.
2. **When combining different burner inputs** in a system, the number of burners per pump (0' - 2,000' altitude) is given by the sum of their inputs:
   a. EP-100 up to 500,000 Btu/h max, but not more than 4 burners.
   b. EP-200 up to 750,000 Btu/h max, but not more than 6 burners.
   c. EP-300 up to 1,600,000 Btu/h max, number of burners is limited to the maximum number of burners listed in *Table 11* for the largest input model used.

Table 11: Number of Burners Allowed Per Pump

Pump Model	Altitude	CTHN-40	CTHN-60	CTHN-80	CTHN-100	CTHN-125	CTHN-150	CTHN-175	CTHN-200
EP-100	0' - 2,000'	4	4	4	4	4	3	2	2
	2,001' - 3,000'	4	4	4	4	3	3	2	2
	3,001' - 4,000'	4	4	4	4	3	2	2	2
	4,001' - 5,000'	4	4	4	4	3	2	2	2
	5,001' - 6,000'	4	4	4	4	3	2	2	2
	6,001' - 7,000'	4	4	4	3	3	2	2	2
	7,001' - 8,000'	4	4	4	3	3	2	2	1
	8,001' - 9,000'	4	4	4	3	2	2	2	1
EP-200 Series	0' - 2,000'	6	6	6	6	6	5	4	4
	2,001' - 3,000'	6	6	6	6	6	5	4	3
	3,001' - 4,000'	6	6	6	6	5	4	4	3
	4,001' - 5,000'	6	6	6	6	5	4	4	3
	5,001' - 6,000'	6	6	6	6	5	4	3	3
	6,001' - 7,000'	6	6	6	6	5	4	3	3
	7,001' - 8,000'	6	6	6	6	5	4	3	3
	8,001' - 9,000'	6	6	6	6	5	4	3	3
EP-300 Series	0' - 2,000'	16	16	14	12	12	10	8	8
	2,001' - 3,000'	16	16	14	12	12	9	8	7
	3,001' - 4,000'	16	16	14	12	11	9	8	7
	4,001' - 5,000'	16	16	14	12	10	9	7	6
	5,001' - 6,000'	16	16	14	12	10	8	7	6
	6,001' - 7,000'	16	16	14	12	10	8	7	6
	7,001' - 8,000'	16	16	14	12	10	8	6	6
	8,001' - 9,000'	16	16	14	12	10	8	6	6

9.4 Radiant Tube Length

The radiant tube length fixed for each burner is shown *on Page 30, Table 10*.

9.5 Manifold Tube

Any tube beyond the radiant tube length is considered manifold. Manifold tube can be used to lengthen tube runs beyond the radiant tube length; to connect multiple runs of tubing and connect the system to the pump. **Minimum and maximum manifold tube lengths are shown** *on Page 30, Table 10***. The table must be used in conjunction with the additional rules for the diameter and length of manifold in a system, as described** *on Page 31, Section 9.5.1 through Page 35, Section 9.6.3***.**

9.5.1 Manifold Diameter

1. Manifold diameter for systems containing less than 320,000 Btu/h input can be 4" (10 cm) or 6" (15 cm).
2. Manifold diameter for systems containing 320,000 Btu/h input and greater must be 6" (15 cm).
   Exception: If total manifold tube length is 70' (21 m) or less, 4" (10 cm) diameter manifold tube can be used for systems up to 800,000 Btu/h.

9.6 Multiburner System Layouts and Manifold Tube Length Rules

Most CTHN multiburner layouts can be classified as one of the following five layout types:

Flag, Modified In-Series, T, Fork or Herringbone. Please refer to *Page 31, Section 9.6.1 through Page 35, Section 9.6.3* for explanation of manifold rules and basic diagrams of each layout type. The diagrams show very simple examples of each layout type. Actual layouts will vary in total number of burners in the system as well as the overall shape of the system. Additional pieces such as elbows may change the overall layout appearance but are usually considered a variant of one of the five multiburner layout types.

9.6.1 Flag and Modified In-Series Layouts and Manifold Tube Length Rules

See Page 32, Figure 19 through Page 32, Figure 20 for diagrams of Flag and Modified In-Series layouts. Minimum and maximum manifold tube length applies to all tubing between the end of a radiant tube run and a tee or cross; all tubing between any tees and/or crosses; and all tubing between the last tee or cross and the pump. *See Page 30, Table 10*.

Example: Consider a Flag or Modified In-Series layout with five CTHN-100 burners. *Page 30, Table 10* shows a minimum of 6' (2 m) and a maximum of 45' (13.5 m) of manifold tube required per burner. Therefore the entire five-burner system must have between 30' (10 m) and 225' (69 m) of manifold tubing. The manifold tubing is in addition to the 40' (12 m) of radiant tube per burner. Radiant tube may end at a tee, or runs may be lengthened by adding some manifold tube between the end of the radiant tube and a tee. Each burner in the system (except for the burner furthest from the pump) must use a damper coupling to properly adjust the vacuum at each burner. The damper coupling may be placed anywhere between the end of the radiant pipe and the tee.

FIGURE 19: Flag Layout

Multiple rows of burners:
pump placed at the end of the manifold tube.

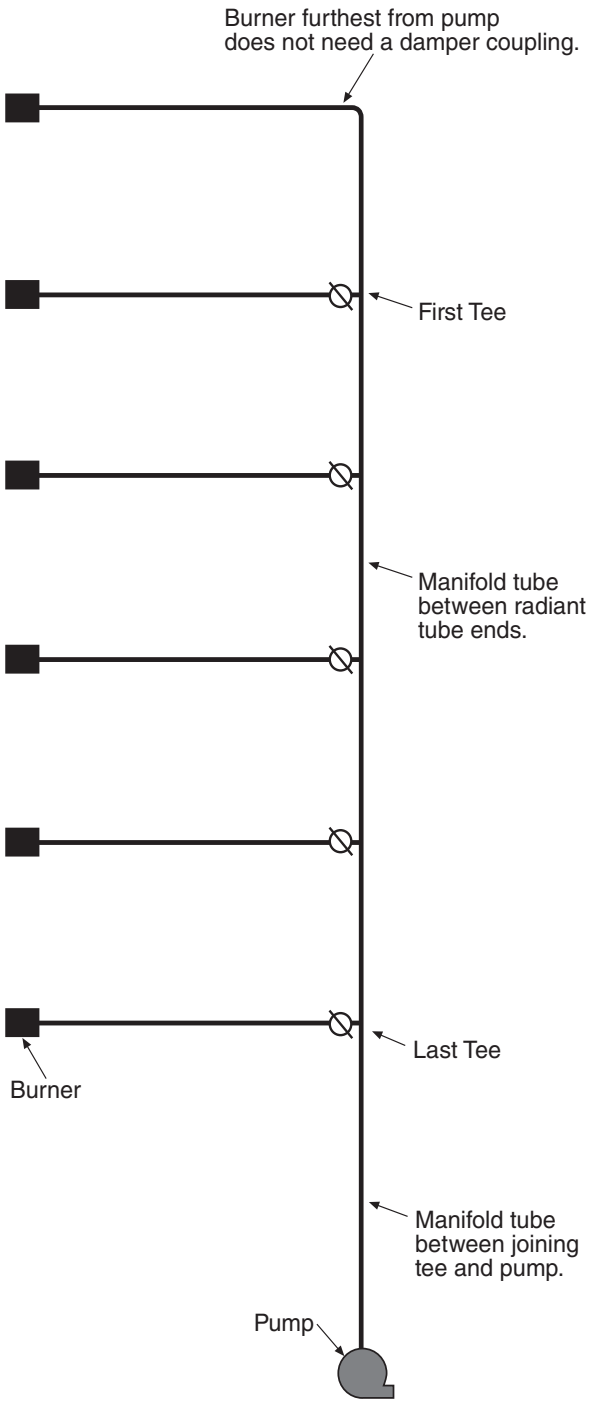
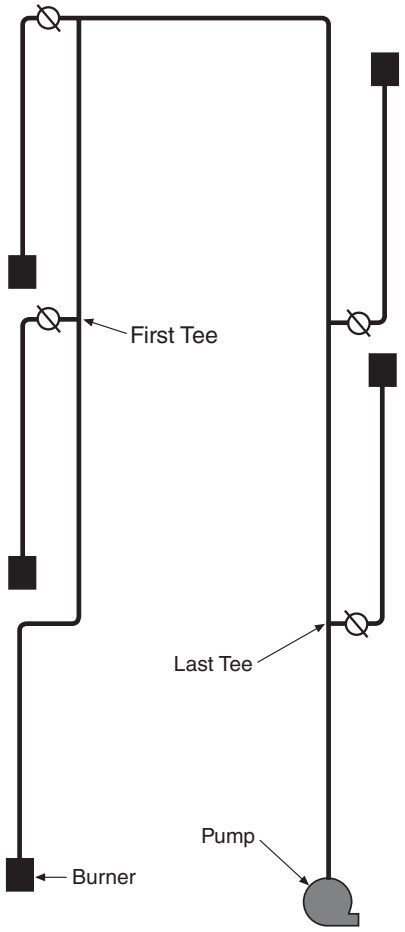


FIGURE 20: Modified In-Series Layout

Multiple burners:
pump placed at the end of the manifold tube.
A variation on the flag layout.



9.6.2 T and Fork Layouts and Manifold Tube Length Rules

See Page 33, Figure 21 through Page 34, Figure 22 for diagrams of T and Fork layouts. The T and Fork layouts have a tee or cross (called the "last tee" or "last cross") where the combustion gases in the system enter the tee or cross with directly opposing flow directions, which creates an added source of pressure drop in the system. This additional source of pressure drop requires some difference in how the allowed manifold length is calculated. In this case, we have to differentiate manifold tube that is located between the radiant pipe and the last tee (or cross) from manifold tube that is located between the last tee (or cross) and the pump.

First determine the length of manifold tube between the radiant tube end and the last tee (or cross). Do not count any tube length twice. Now refer to *Page 30, Table 10* and find the maximum manifold tube length for each burner. Add together the maximum manifold tube length on the table for each burner in the system, this is the maximum manifold tube length for the entire system.

To determine the maximum manifold tube allowed between the last tee (or cross) and the pump: Subtract the manifold tube length between the radiant tube and the last tee (or cross) from the maximum manifold length for the entire system, then divide that number by 1.5.

Example: Consider a T layout with two CTHN-100 burners. *See Page 33, Figure 21*. Assume that 15' (4.5 m) of manifold was used from each radiant tube end to the last tee. *Page 30, Table 10* indicates that each CTHN-100 burner can have a maximum of 45' (13.5 m) of manifold tube. Therefore the maximum manifold tube length amount allowed between the last tee and the pump in this case is ([45' + 45']-[15' x 2])/1.5 = **40'** or in metric, ([13.5 m + 13.5 m]-[4.5 m x 2])/1.5 = **12 m**.

FIGURE 21: T Layout

One pair of burners.

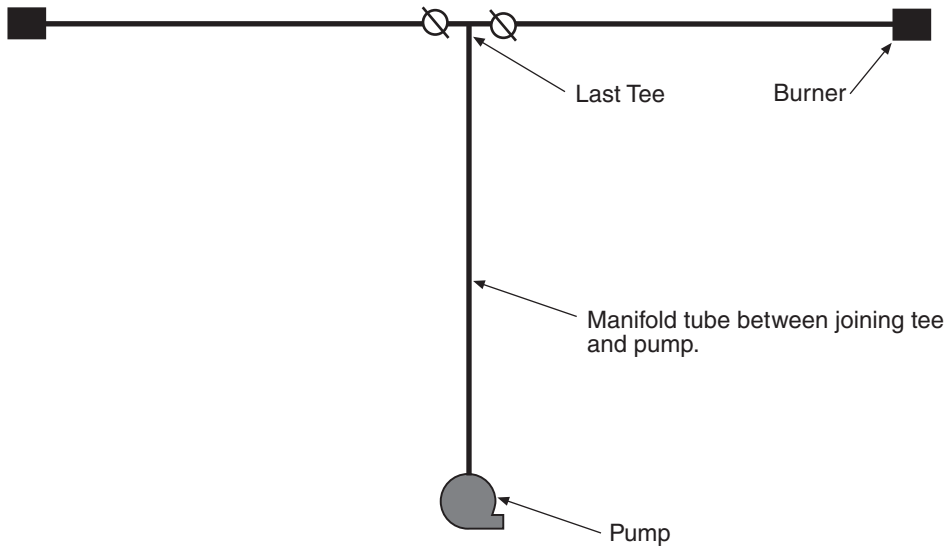
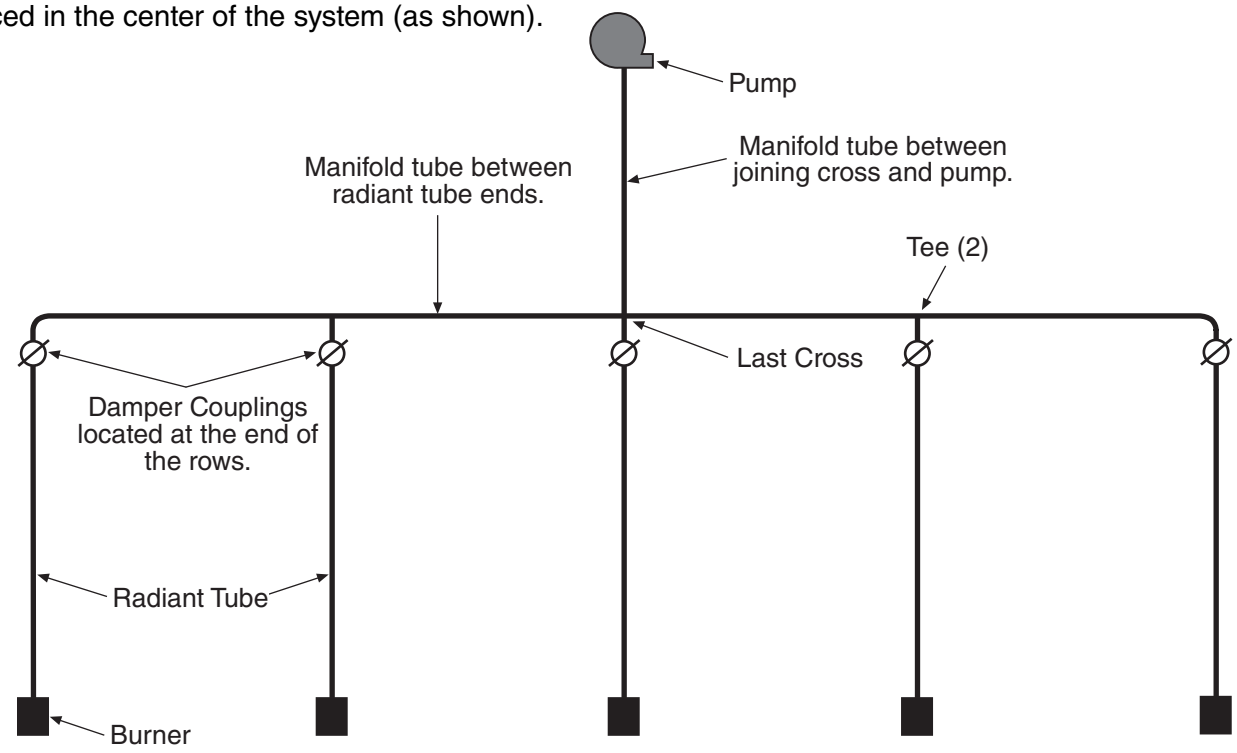


FIGURE 22: Fork Layout

Multiple rows of burners:
Manifold tube between the last tee or cross and the pump is perpendicular to the manifold tube joining the rows. Pump is not required to be placed in the center of the system (as shown).



9.6.3 Herringbone Layout and Manifold Tube Length Rules

The herringbone layout is essentially several T layouts stacked together. Therefore, the same principle for manifold tube calculation as used for T layouts is used for herringbone layouts, with one exception. In a herringbone layout, the manifold tube length between tees (or crosses) as well as between the last tee (or cross) and the pump is calculated by dividing by 1.5 as shown in the T example *on Page 33, Section 9.6.2*. The only manifold tube length in a herringbone layout that is not divided by 1.5 is any manifold tube length located between the end of the radiant tube and a tee or cross.

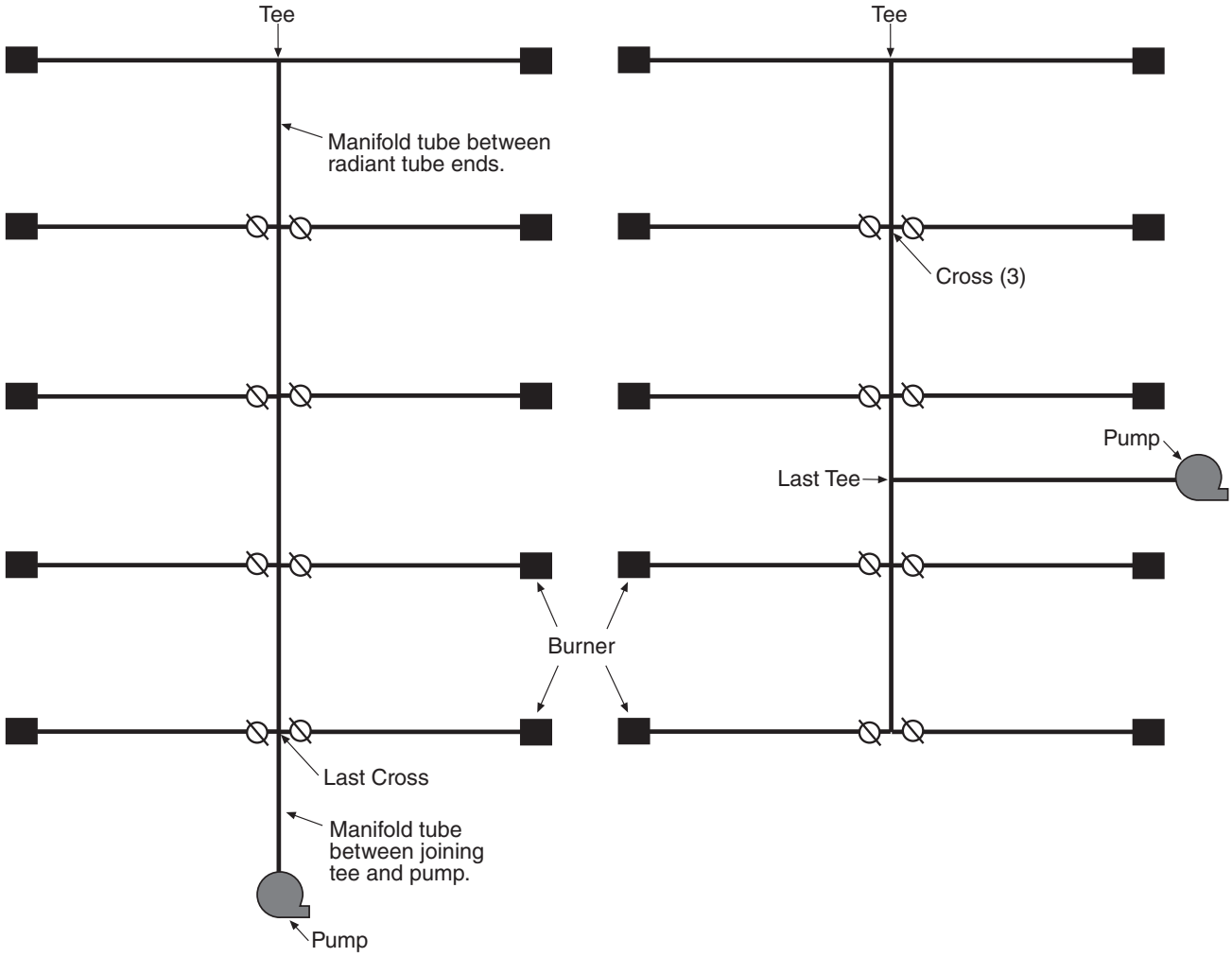
Example: Consider a herringbone layout similar to the layout on the left in *Figure 23*, having ten CTHN-100 burners. Assume that each heater has 40' (12m) of radiant tube and 10'(3m) of manifold tube before the connecting tee or cross.

According to *Table 10* each burner must have at least 40' (12m) of radiant tube, also each burner must have between 6' (2m) and 45' (13.5m) of manifold tube. Each burner has already met the minimum manifold pipe requirement due to the 10' (3m) of manifold tube before the connecting tees and crosses. The maximum manifold tube length for the entire system is 10 burners X 45' (13.5m) = 450' (135m). Subtract the 100' (30m) that has already been used before the connecting tees/crosses and 350' (105m) remains.

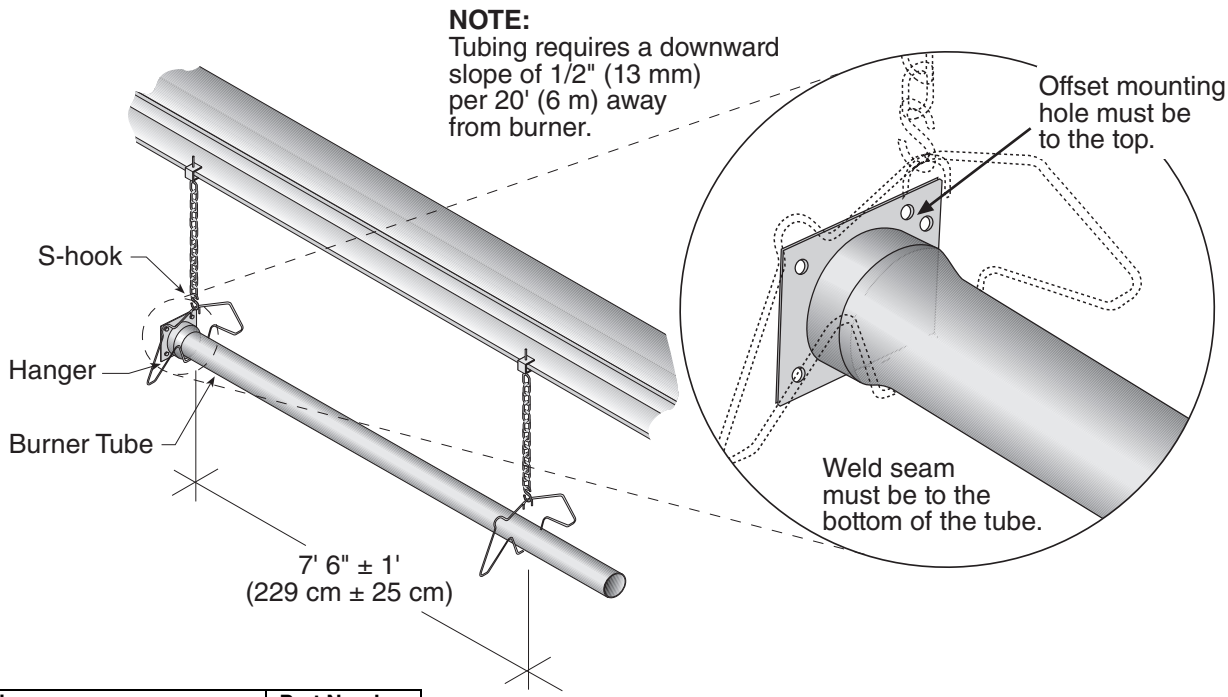
Since the remaining manifold is located either between or after connecting tees or crosses, the manifold length must be divided by 1.5. 350' (105m)/ 1.5 = 233' (70m). Therfore, up to 233' (70m) can be used between the branches and also between the last cross and the pump.

FIGURE 23: Herringbone Layout

Multiple opposing rows of burners: pump placed at the end of the manifold tube or somewhere between the burners.



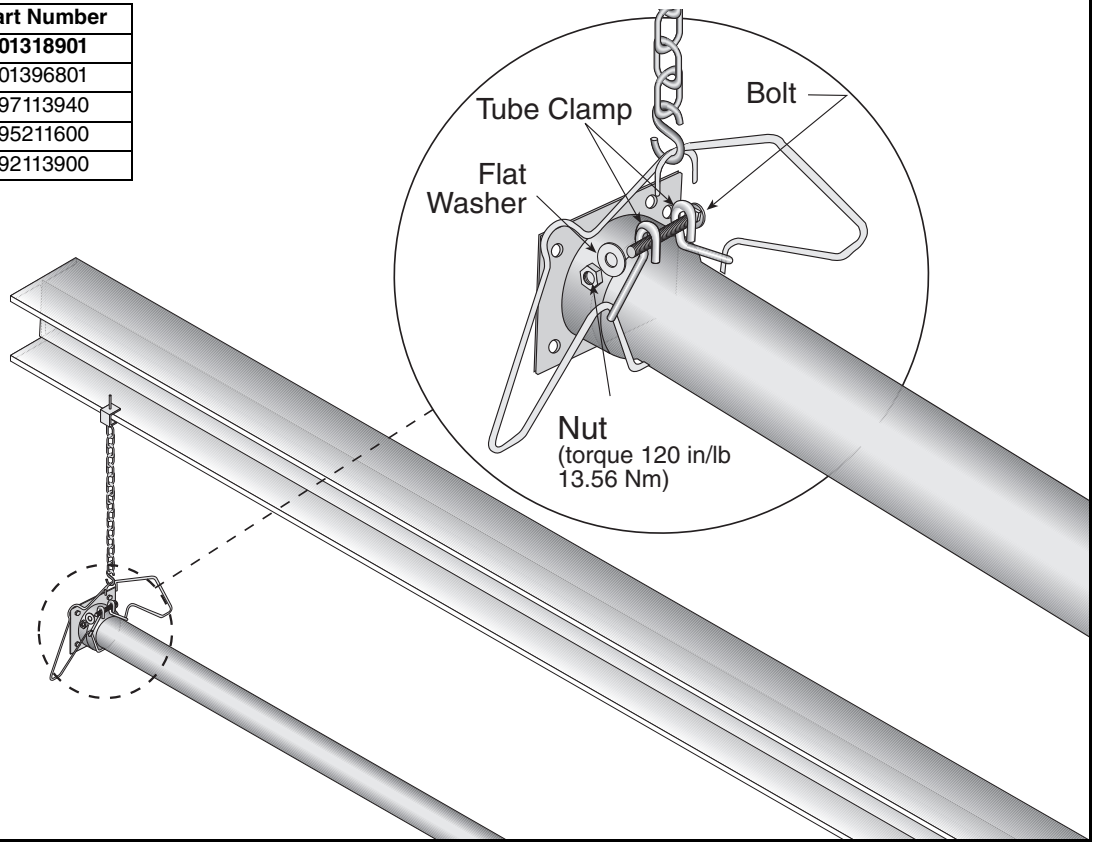
Step 9.7 Burner Tube Installation


NOTE:
Tubing requires a downward slope of 1/2" (13 mm) per 20' (6 m) away from burner.
Offset mounting hole must be to the top.
S-hook
Hanger
Burner Tube
Weld seam must be to the bottom of the tube.
7' 6" ± 1'
(229 cm ± 25 cm)

Description	Part Number
Burner Tube	03051XXX
S-Hook	91907302
Tube/Reflector Hanger	03090100

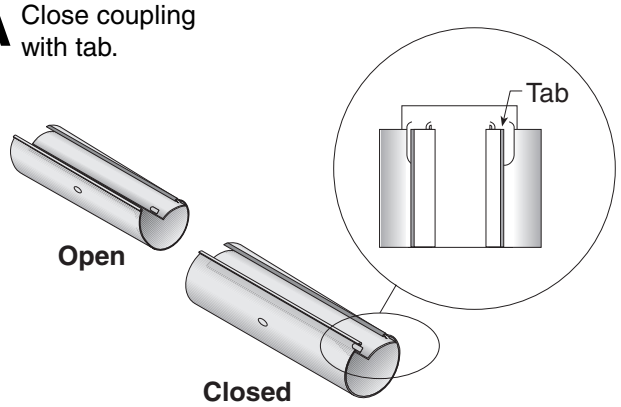
Step 9.8 Tube Clamp Package Installation

Description	Part Number
Tube Clamp Package	**01318901**
Tube Clamp	01396801
Bolt	97113940
Flat Washer	95211600
Nut	92113900

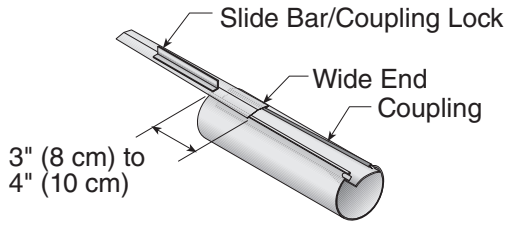


Step 9.9 Coupling and Tube Assembly

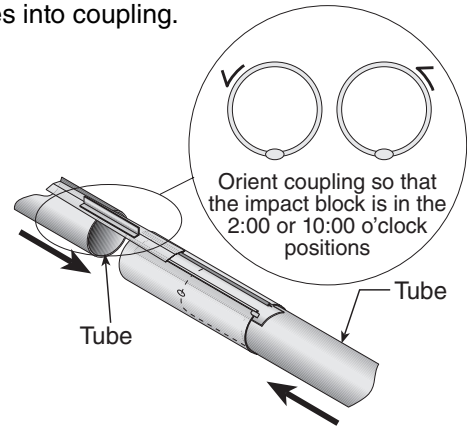
A Close coupling with tab.



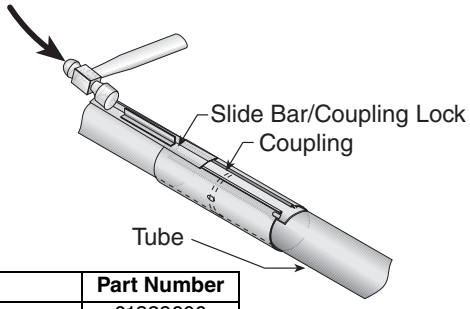
B Start slide bar/coupling lock onto coupling.



C Insert tubes into coupling.



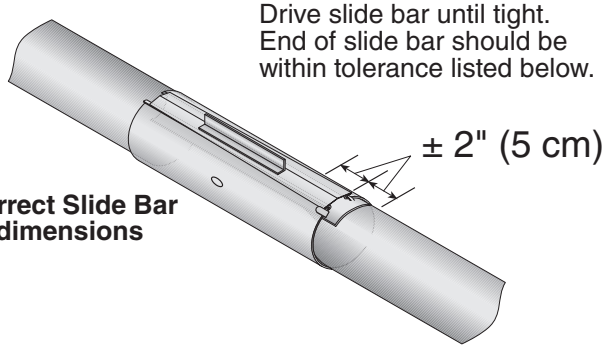
D Tighten coupling to join tubes.

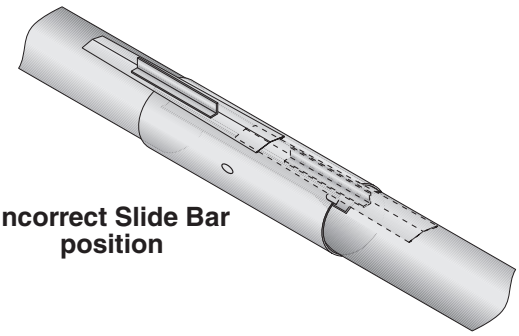


Description	Part Number
Coupling	01329600
Slide Bar/Coupling Lock	01329700
Tube	91409XXX

Step 9.9.1 Coupling and Tube Assembly (Continued)

Tighten slide bar as shown below.

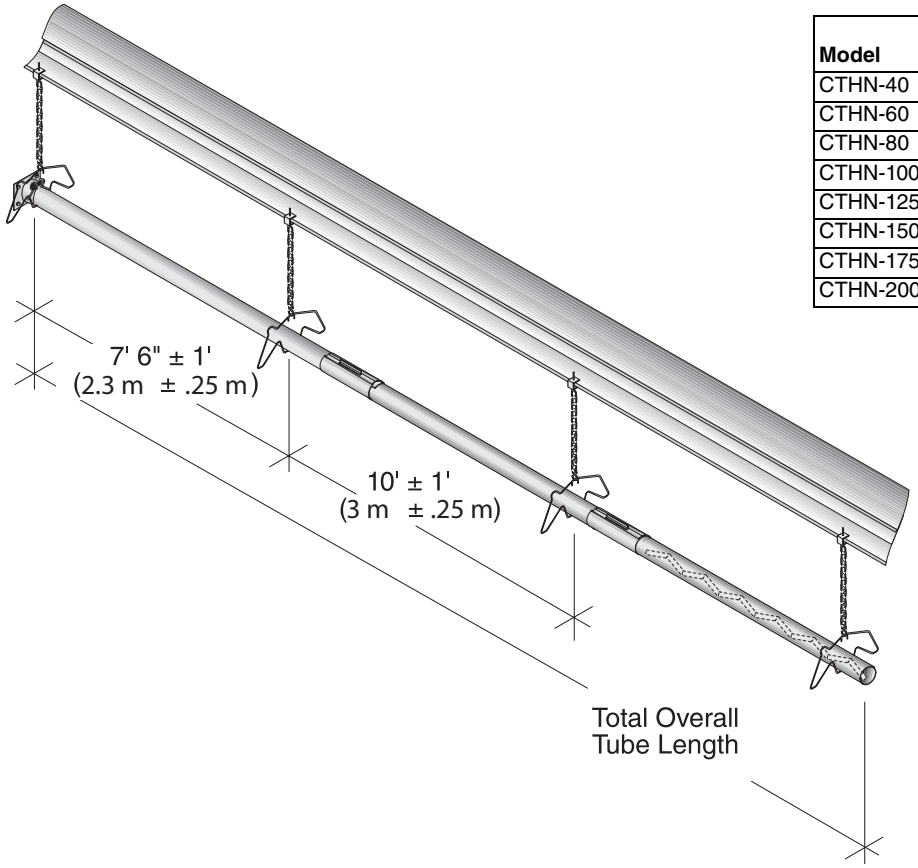




• **Repeat** *Step 9.9 on Page 37*, **A - D until all tubes are assembled.** *See Page 38, Step 9.9.2*.

NOTE: If coupling is not tight, loss of vacuum can occur.

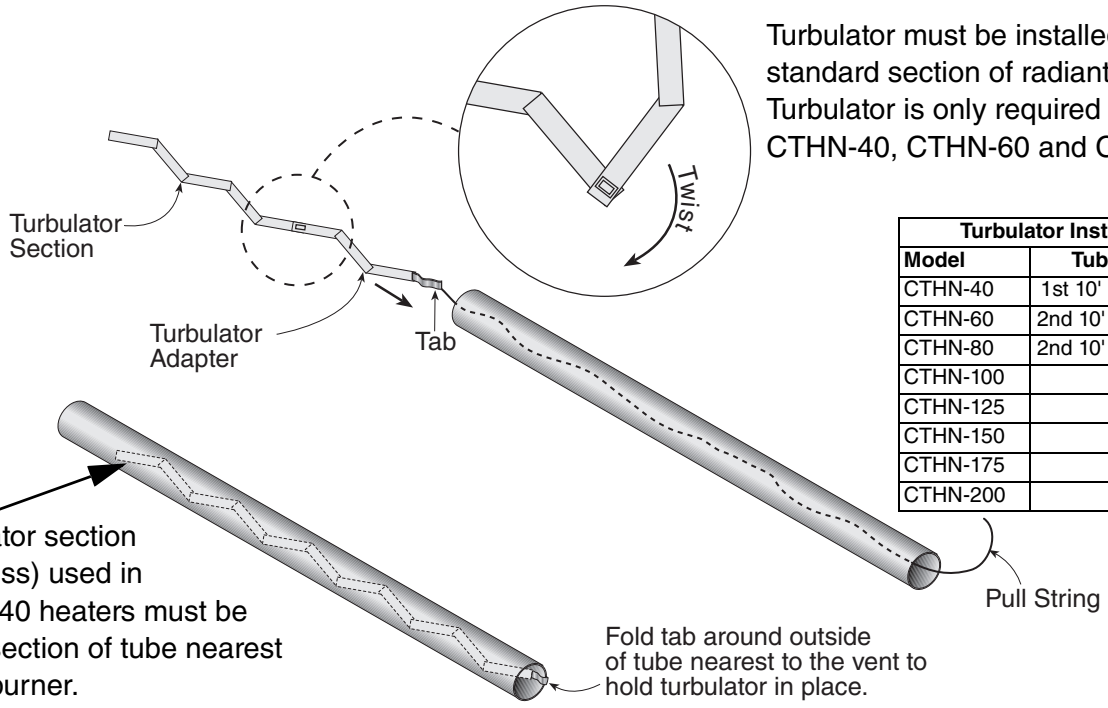
Step 9.9.2 Coupling and Tube Assembly (Continued)



Model	Radiant Tube Length
CTHN-40	10' (4.5 m)
CTHN-60	20' (6 m)
CTHN-80	20' (6 m)
CTHN-100	30' (9 m)
CTHN-125	40' (12 m)
CTHN-150	40' (12 m)
CTHN-175	50' (18 m)
CTHN-200	50' (18 m)

Step 9.10 Turbulator Installation

Turbulator must be installed in the last standard section of radiant tube. Turbulator is only required on the CTHN-40, CTHN-60 and CTHN-80.



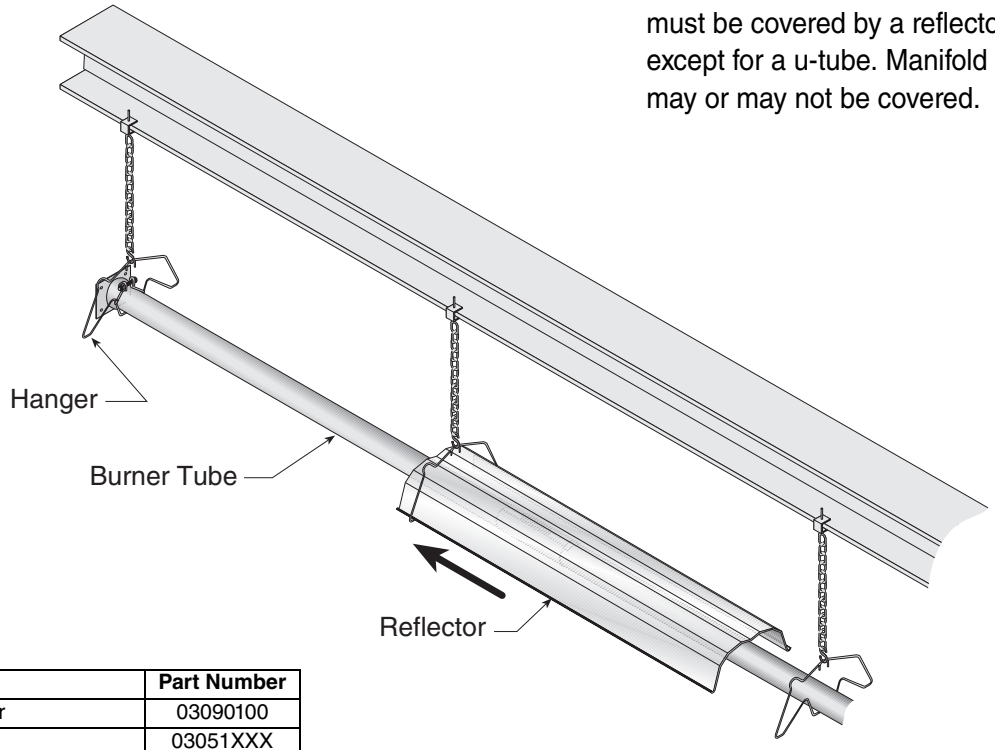
Turbulator Installation	
Model	**Tube Section**
CTHN-40	1st 10' (3 m) Section
CTHN-60	2nd 10' (3 m) Section
CTHN-80	2nd 10' (3 m) Section
CTHN-100	N/A
CTHN-125	N/A
CTHN-150	N/A
CTHN-175	N/A
CTHN-200	N/A

Turbulator section (stainless) used in CTHN-40 heaters must be in the section of tube nearest to the burner.

Description	Part Number
Turbulator Adapter	03051503
Turbulator Section	03051504
Turbulator Section (Stainless)	03051505
Tube	91409XXX

Step 9.11 Reflector Installation

NOTE: All radiant tube surfaces must be covered by a reflector, except for a u-tube. Manifold tube may or may not be covered.



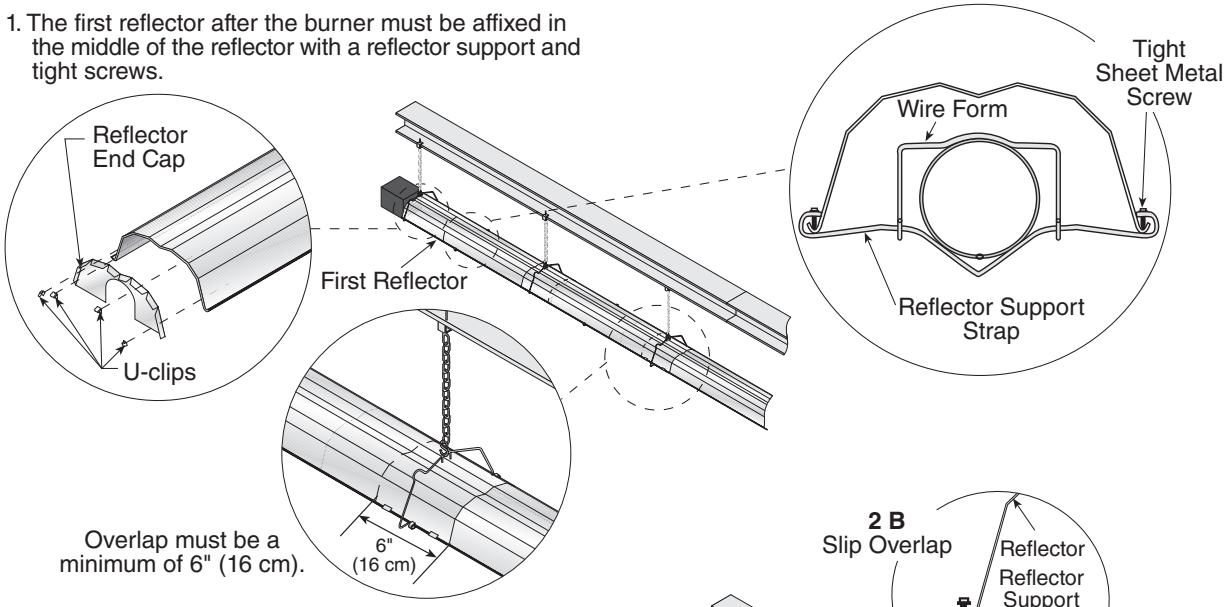
Description	Part Number
Tube/Reflector Hanger	03090100
Burner Tube	03051XXX
Reflector	02750303

Step 9.11.1 Reflector, U-clip and Reflector Support Installation

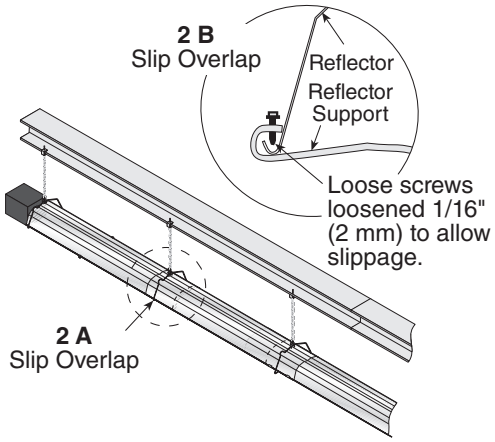
The pictorial drawings of the heater construction in *Section 9* are schematic only and provide a general guideline of where hangers, reflector supports and u-clips are to be installed.

To ensure proper expansion and contraction movement of the reflectors, a combination of u-clips and reflector supports are used. The positioning of reflector supports and u-clips depend on the individual installation. Use either pop rivets or sheet metal screws instead of u-clips when installing end caps and joint pieces in areas where impact and high wind may be a factor. The following rules must be observed.

1. The first reflector after the burner must be affixed in the middle of the reflector with a reflector support and tight screws.

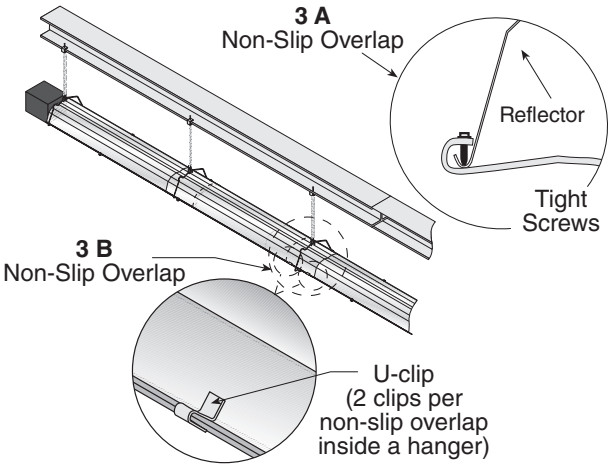


2. The overlap at the first and second reflector is a **slip overlap.** Thereafter, every third reflector joint is a slip overlap. A slip overlap is achieved by either:
   a.) both reflectors lay inside a hanger. (No reflector support needed.)
   b.) using a reflector support with loose screws at the reflector overlap.



3. The remaining reflector overlaps require a **non-slip overlap** connection. To affix the reflectors together in a non-slip overlap either:
   a.) use reflector support and tight screws.
   b.) if both reflectors lay inside a hanger, u-clips or sheet metal screws may be used.

   This section of three reflectors joined together must be affixed to the tube with at least one reflector support with tight screws.



Description	Part Number
Reflector Support Package	**03050010**
Wire Form	91908004
Reflector Support Strap	03050000
Screw #8 x 3/4	94320812
U-clip Package	91107720
Reflector End Cap	027508XX